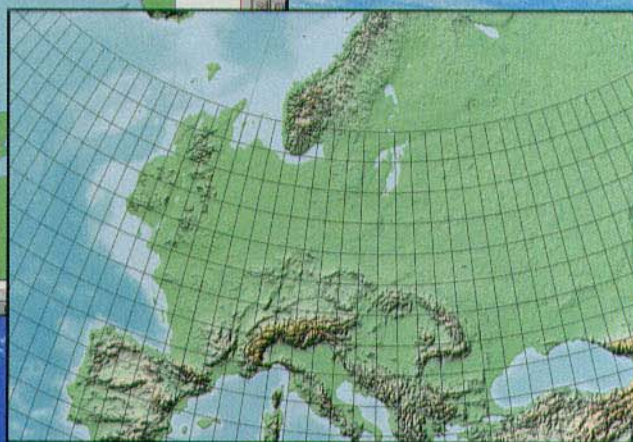
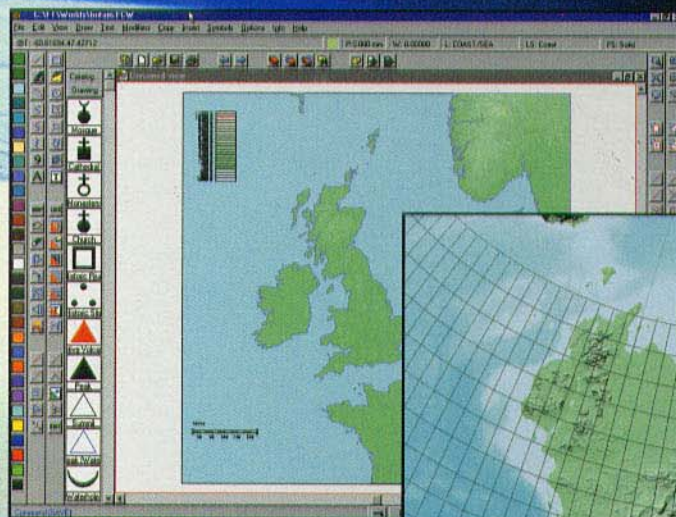


Windows® 95/98/2000 &
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The best of all possible worlds

Fractal Terrains



A stand-alone product

Fractal Terrains



User's Guide



ProFantasy Software

PROFANTASY SOFTWARE PRESENTS

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INTRODUCTION

Welcome to Fractal Terrains (FT). This book contains step-by-step examples that show you how to create pseudo-realistic worlds, quickly and easily, that can be exported for further enhancement using Campaign Cartographer 2 (CC2). While CC2 is not required to make use of FT, the two, when used together, can produce some startling results. Complete tutorials, the herein, and you will be creating your own worlds in short order.

Other Sources of Information

FT's Help System. When you are using FT you can get in-depth information by pressing , or by selecting Help from FT's Help menu.

Web Based Tech Support. ProFantasy's web site www.profantasy.com has a comprehensive technical support section and details about e-mailing for help.

The CC2 mail-list. This is a very active e-mail discussion group to help new users and discuss all things map related. To subscribe follow the instructions at the ProFantasy Software web site, www.profantasy.com

Installing FT

Place the FT compact disc into your CD-ROM drive. On most computers there will be a few seconds of whirring, then you will see a window showing the contents of the CD. If this doesn't happen, double-click on "My Computer", then on the icon for your CD-ROM drive.

To install FT, double-click on the **Setup** icon, then follow the on-screen instructions.

During the installation you will be asked to give your name, company and FT Serial number. Your unique serial number is in the back of this manual. If the company box is blank, you will have to enter something, even if it is only one character!



the Setup
icon

Starting FT

Once you have completed the installation, start FT. You can do this by double-clicking on the FT icon on your computer's desktop, or by locating FT within your Windows® Start menu.

FT will attempt to load file you were working on when it was last closed. If you did not manage to close FT down cleanly when last used (e.g., your system crashed, or FT stopped responding due to errors in a binary file you were attempting to import), you may experience problems starting FT as it might be attempting to read data from a corrupt file.

If you do experience such problems, it is recommended that you start FT by double-clicking on a FT file that is known to function normally (either one of your own files, or one of the example files provided on your FT CD will suffice) from Windows® Explorer.

Latest Information

To find out about any additions to FT since this manual was written, double-click the **Readme** icon on the CD.

The FT CD

It is worthwhile exploring your FT CD beyond the installation setup files. Therein, you will discover examples of worlds created with the software, as well as real-world data that can be used with FT to produce realistic maps based the geography of Earth and Mars. Also included is the latest version of *Wilbur*, a fairly comprehensive fractal world generation tool that possesses a less advanced CC2 export capability. While FT is ideal for quick generation of worlds, shielding you somewhat from the fractal theory the software uses, *Wilbur* is an excellent tool for those wishing to explore this theory to greater depth.

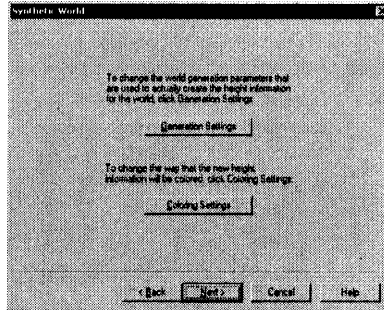
For more information about *Wilbur* and real-world data, please refer to the "Readme" and "Credits and Thanks" text files on the CD, respectively. Documentation for *Wilbur* is also provided.

For now, we shall create a synthetic (random) world.

Tutorials covering flat worlds and those created using binary files can be found later in this manual.

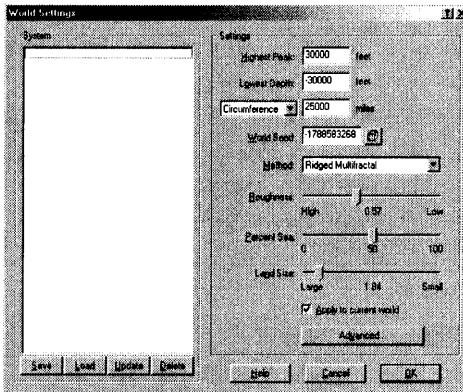
- 2 ▼ Ensure that the **Synthetic World** radio button is checked, and click on the **Next** button.

You see the Synthetic World dialog box:



- 3 ▼ Click on the **Generation Settings** button.

You see the World Settings dialog box:

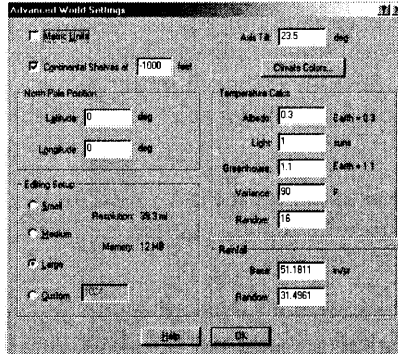


The settings here affect the way in which your new world will be created. These will be explained later. For now, leave them as they appear.

You may save the settings for later use.

- 4 ▼ Click on the **Advanced** button.

You see the Advanced World Settings dialog box:



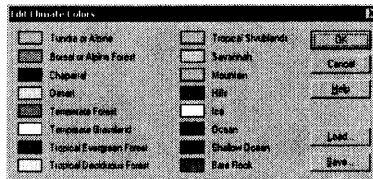
Again, the settings presented by this dialog are further explained later.

- 5 ➤ Select the **Small Editing Setup** radio button.

Changing this setting will affect the resolution used to depict your world, and the amount of memory FT will need. For your first world, we will use the Small setup to save time while you explore FT's functions.

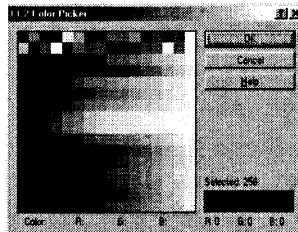
- 6 ▼ Select the **Climate Colors** button.

You see the Edit Climate Colors dialog box:



- 7 ▼ Left-click on one of the color boxes.

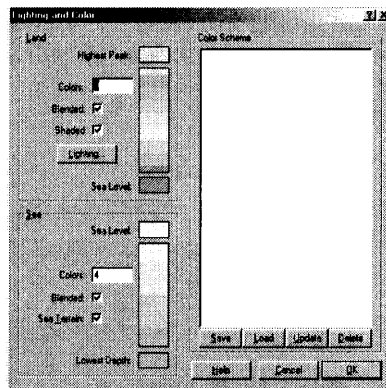
You see the CC2 Color Picker dialog box.



This dialog box is used throughout FT when selecting colors. As you move your mouse over the color window, the RGB (Red/Green/Blue) values immediately below the window change to reflect the color currently beneath your cursor. You can choose a color by left-clicking in the window. The color box and RGB values to the left will change to reflect your choice. The **Selected** number indicates the chosen color's value within the standard CC2 palette.

- 8 ➤ Unless you wish to change the color used for the climate form you have chosen, press **Cancel** to return to the Edit Climate Color dialog box.
- 9 ➤ Press **OK** to return to the Advanced World Settings dialog box, and again to return to the World Settings dialog, and once more to return to the Synthetic World dialog.
- 10 ▼ Click on the **Color Settings** button.

You see the Lighting and Color dialog box:



As with the Edit Climate Colors dialog box, you may change the colors used for land height and sea depth contours by left-clicking on the color boxes.

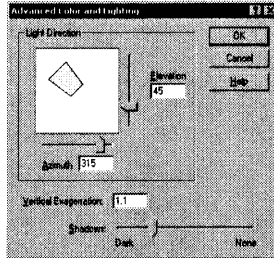
If the **Blended** check boxes are set, FT will draw the contour colors so that the transition between one contour and the next flows smoothly. While this produces a more realistic look, it can slow down world redraws.

If the **Shaded** check box is set, FT will calculate and draw shaded highlights to raised terrain features. As with blending, shading can slow down redraw times, but will produce a more realistic effect. The **Sea Terrain** check box is used to tell FT whether to draw similar shading for sea depth contours.

You can save your choices to a scheme for use in other worlds of your creation.

- 11 ✓ Click on the **Lighting** button.

You see the Advanced Color and Lighting dialog box.



This box is used to define how contour shading will appear for your world. You can set the vertical (Elevation) and horizontal (Azimuth) angle at which light will appear to strike your world, as well as the intensity of the shading that will be used.

- 12 ➤ Press **OK** to return to the Lighting and Color dialog box, and again to return to the Synthetic World dialog.
- 13 ➤ Press **Next**.

You see a dialog box summarizing the world settings you have chosen. For synthetic worlds, this dialog will be relatively empty.

- 14 ➤ Press **Finish** to complete your world.

FT will spend a few moments calculating, and will then draw the world into the main screen.





Congratulations! You have just created your first world.

NAVIGATING THE WORLD

FT possesses functionality allowing you to move about your world, and to zoom into and out of areas within it. It is a good idea to become familiar with these various functions, as they will be useful when you come to edit and otherwise play with your new creation.

Zooming In and Out


To change the zoomed view of your world:

- ✓ Clicking on the **Zoom In** icon  will change the view so that it is zoomed in by a factor of two.
- ✓ Clicking on the **Zoom Out** icon  will change the view so that it is zoomed out by a factor of two.
- ✓ Clicking on the **View Whole World** icon  will change the view so that the entire world fits within the display window.
- ✓ Clicking on the **View Windowed Area** icon  will allow you to draw a box within your world's view by left-clicking to place opposite corners. The view will change to show a zoomed view of the area within that box.

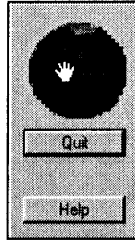
Moving around on the main map

You can change the viewed world area at the current zoom level by either panning, or by rotating the small globe in the upper right hand corner of the main FT window.

To pan the current view:

- 1 ➤ Click on the **Pan** icon .
The mouse pointer will change to show a hand.
- 2 ➤ Left-click and hold the mouse button down within the world view.
The mouse pointer will appear to “grab”.
- 3 ➤ Move the mouse in the desired pan direction.
The world view will move with the mouse. Notice that, as you move the mouse around, the small globe will appear to rotate in the desired direction.
- 4 ➤ When the desired view appears, release the left mouse button.
FT will re-draw the world to show the new view.

Moving around using the Globe



The small globe may also be rotated directly to achieve the view you desire. To pan your world using the globe:

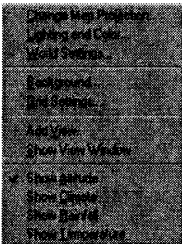
- 1 ➤ Move the mouse pointer over the globe.
The mouse pointer will change to show a hand.
- 2 ➤ Left-click and hold the mouse button down.
The mouse pointer will appear to “grab”.
- 3 ➤ Move the mouse in the desired pan direction.
The world view will change to depict the new orientation of the globe.
- 4 ➤ When the desired view appears, release the left mouse button.
FT will re-draw the world to show the new view.

Using the globe can be useful at times, especially when editing.

Named Views

You can create named views for your world. When a named view is created, map projection, scale, and position are stored within it. Named views can be used for world navigation and to export sections of worlds.

Creating named views



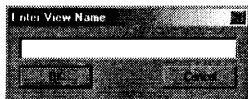
- 1 < Right-click within FT's main screen.

You see the Context menu.

The Context menu provides a quick mouse shortcut to some of the more commonly used commands. You can use it, by right-clicking, instead of using the standard menu and icons to access these commands.

2 ✓ **Select Add View.**

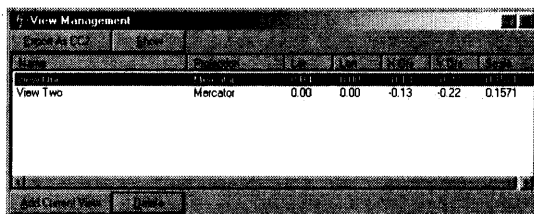
You see the Enter View Name dialog box:

**3** ➤ **Enter a name for your view, and press OK.**

View names are case sensitive, and can have a maximum of 60 characters. If you intend to export saved views (see *Using named views*), it is advisable to use legal Windows® file names.

Using named views

Once you have created named views for your world, you can access them via the Context menu. The **Show View Window** command opens the View Management dialog box:

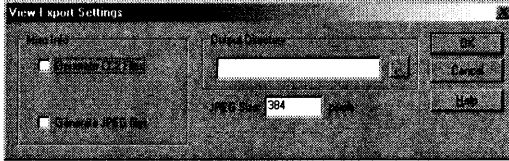


All named views created for the current world will be listed within the dialog, along with the stored parameters for each. To make use of the View Management functions, select one of the listed views by left-clicking on its list entry.

Multiple named views can be selected by holding down **Ctrl** while clicking to select, and selecting names individually, or holding down **Shift** to select a range of view names.

- ✓ **Show** will change the current world view to reflect the settings stored within the selected named view. Double-clicking on a named view's list entry has the same effect.
- ✓ **Add Current View** will add the current world view as a named view. This function works in the same way as the **Context menu >> Add View** command.
- ✓ **Delete** will remove the selected named views.

- ✓ **Export As CC2** exports the currently selected named views as CC2 and/or JPEG files:




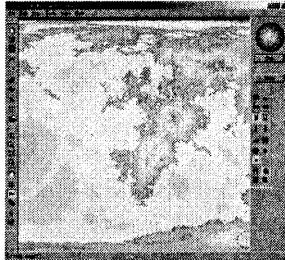
- ✓ Checking the **Generate CC2 Files** box will export the selected named views as CC2 maps. When checked, FT will prompt for selection of an existing CC2 export file (see *Saving And Exporting*).
- ✓ Checking the **Generate JPEG Files** box will export the selected named views as JPEG images. The **JPEG Size** entry is used to determine the width of the exported JPEG images.
- ✓ **Output Directory** allows selection of the directory in which the exported files will be saved. If no directory is specified, then the current one will be used.
- ✓ Exported named views carry file names that reflect their view names. If you wish to use named views for export, you should take care to use only names that are valid Windows® file names, and back up or change the names of existing images and maps that may be affected.


VIEWING WORLD INFORMATION

From what we have explored thus far, we know that FT can calculate and show height contours for a world. The clever little beastie does not stop at that, however.


When a world is created, FT will automatically determine its climate, temperature, and rainfall, as well as its general geography. While these calculations are based more on theory than any “true to life” scenario (for example, viewing the climate for your world will very likely reveal huge expanses of forestland - such factors as deforestation and axe-wielding settlers are not figured in the climate calculations), they can be very useful when it comes to adding the finishing touches. As we shall see later, any of these factors that do not suit your concept can easily be changed.

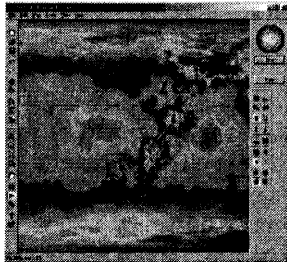
- ✓ Click on the **Show Altitudes** icon  to show your world's height contours and general geography (this is the default view).




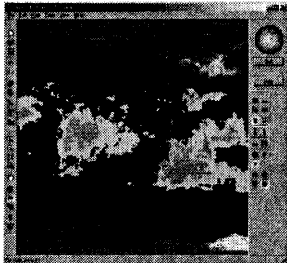
- ✓ Click on the **Show Climate** icon  to show the climate zones FT has calculated for your world.



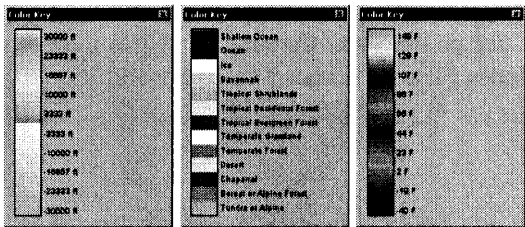
- ✓ Click on the **Show Temperature** icon  to show the temperature zones FT has calculated for your world.




- ✓ Click on the **Show Rainfall** icon  to show precipitation levels FT has calculated for your world.



For each of these views, different colors are used to indicate the different values FT has calculated. The colors and their associated values are shown within the Color Key window. When you change the view mode, the Color Key window will change accordingly:



You can also measure linear distances across a world. Click on the **Distance** icon , and click both ends of the linear distance you wish to measure. FT will report the measurement.

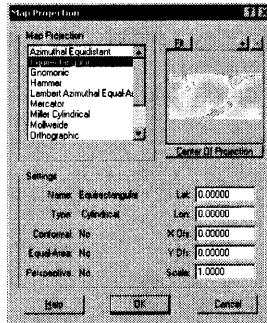
WORLD PROJECTIONS

Displaying a globe on a flat surface poses somewhat of a problem. Over the years, several different methods of achieving this have been devised. Such methods produce flat-map views, or projections, of the globe. FT has the capability to display your world using many of these.

To change the projection used to display your world:

- 1 ▼ Click on the **Change Projection** icon .

You see the Map Projection dialog box:



- 2 ➤ Left-click on one of the listed map projections.
The preview of the world will change to reflect the selected projection.
- 3 ➤ Keep cycling through the available map projections until you find one that you like.
- 4 ➤ Press OK.
The view of your world will be updated to reflect the new projection.

The Map Projection dialog has three basic sets of parameters: Projection Center, represented by the values Lat (latitude) and Lon (longitude), defines the central point for the projection display; View Offset (represented by XOfs and YOfs) defines the offset from the projection center to the center of the area of interest; and Scale, expressed as a zoom ratio (e.g., a Scale of 1 will display the entire world, 0.5 will zoom in by a factor of $\times 2$, 4 will zoom out by a factor of $\times 1/4$, and so on).

View Offsets can be used to center a view to a particular latitude and longitude co-ordinate. To calculate the values required to do this, use the following formulae:

$$XOfs = \frac{-\textit{longitude}}{180}$$

$$YOfs = \frac{-\textit{latitude}}{180}$$

For example, to center the view to longitude -117, latitude 35 the values used would be 0.65 (XOfs) and -0.19444 (YOfs).

Further discussion regarding map projections appears within the reference section to the rear of this manual.

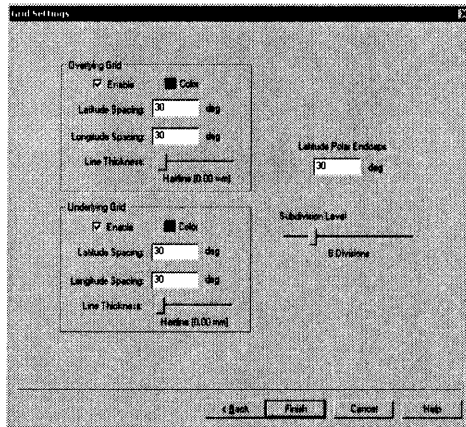
ADDING A GRID

FT has the capability of adding gridlines to your map. Since grids are based upon longitude and latitude, the manner in which a grid is displayed will depend upon the current projection used.

To add a grid to your world:

- 1 ▼ Left-click on the **Grid Settings** icon .

You will see the Grid Settings dialog box:

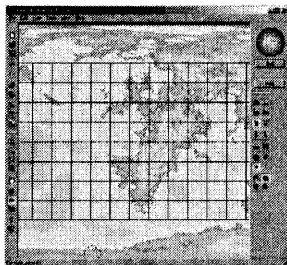


You can define up two separate grids. This is useful when you wish to depict a second grid using different longitude and latitude settings.

- 2 ➤ Check the Enable box within the Overlying Grid section.
- 3 ➤ Left-click on the Color box within the Overlying Grid section.
You will see the CC2 Color Picker dialog box.
- 4 ➤ Left-click on the red (color 2) picker box and press OK.
The Overlying Grid color box will change to reflect your choice.
- 5 ➤ Check the Enable box within the Underlying Grid section.
- 6 ➤ Left-click on the Color box within the Underlying Grid section.
You will see the CC2 Color Picker dialog box.
- 7 ➤ Left-click on the purple (color 230) picker box and press OK.
The Underlying Grid color box will change to reflect your choice.

- 8 ➤ Change the Longitude and Latitude Spacing values within the Underlying Grid section so that both are set to 24.
- 9 ➤ Move the Subdivision Level slider bar so that the setting reads “2 Divisions”.
- 10 ▼ Click on **OK**.

The world will re-draw to reflect your grid settings:




EDITING YOUR WORLD

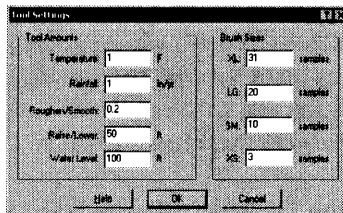
FT does not stop once your world has been created. Perhaps the mountains are too high, the seas too deep, or there is something else that you wish you could change to make your world just so. To this end, FT provides a number of editing tools that can be used to tweak your world.

FT's editing functions are all performed in basically the same way. To edit your world:

- 1 ➤ Click on the icon representing the editing function you wish to use.
The mouse cursor will change to show a paintbrush surrounded by a dashed circle. The circle indicates the area that will be affected by your edit.
You will notice that the information view of the world will change according to the editing tool you have selected. For example, if you select the **Warmer** tool, the view will change to show your world's temperature zones.
- 2 ➤ Move the mouse to the region you wish to edit within your world.
- 3 ➤ Left-click and hold the mouse button down.
- 4 ➤ Move the mouse across the area you wish to edit.
Your edit will be "painted" onto the world as you move the cursor. Since FT needs to calculate edits in order to apply them, it is a good idea to move the mouse slowly to ensure that the edit is applied to the whole region desired.
- 5 ➤ Once you have painted all of the desired area, release the mouse button.

Editing Tools

FT possesses fourteen editing tools, all of which are available via the Tool Palette. You can set the extent to which edits are applied by clicking on the **Tool Options** icon . The Tool Settings dialog box will appear, in which you can specifically set values used by the editing functions:


















Note that the editing tools may have no discernable effect when using low tool settings values at high zoom levels.

Also note that there is a peculiarity in the way brush sizes are set in FT. The software requires that sizes, internally, should be odd values. As a result, it adjusts user-entered values, as per:


Entered Value	Actual Size of Brush
0-1	0
2-3	1
4-5	3
6-7	5
8-9	7
10-11	9
32-33	31
64-65	63

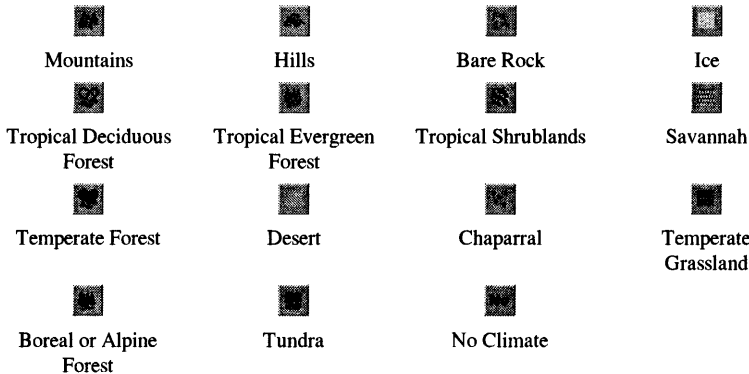
The tools are:

- ✓ **Raise**, , increases the altitude of the painted area.
- ✓ **Lower**, , decreases the altitude of the painted area.
- ✓ **Rougher**, , increases the height variation (roughness) of the painted area.
- ✓ **Smoother**, , decreases the height variation (roughness) of the painted area.
- ✓ **Wetter**, , increases the level of rainfall within the painted area.
- ✓ **Dryer**, , decreases the level of rainfall within the painted area.
- ✓ **Warmer**, , increases the temperature of the painted area.
- ✓ **Colder**, , decreases the temperature of the painted area.
- ✓ **Water Level**, , will adjust the painted area so that its water level is set at a given altitude. All terrain of an altitude lower than that set for the **Water Level** tool will be adjusted to depict water. Higher altitude terrain will not be affected. You can dynamically select the altitude to be used by this tool by holding  down while left-clicking within the world map on an area of the desired altitude.
- ✓ **Paint Climate**, , will replace the current climate of the area painted with that chosen from the Climate Selector toolbar.
- ✓ **Extra-Large Tool**, , will change the size of the paint area to that set for the Extra-Large (XL) brush size in the Tool Settings dialog.


- ✓ **Large Tool**, , will change the size of the paint area to that set for the Large (LG) brush size.
- ✓ **Small Tool**, , will change the size of the paint area to that set for the Small (SM) brush size.
- ✓ **Extra-Small Tool**, , will change the size of the paint area to that set for the Extra-Small (XS) brush size.

Climate Painting

The **Paint Climate** icon, , is used to change the climate settings for an area painted. To use this tool, you must first select the type of climate you wish to paint from the Climate Selector toolbar. Fifteen climate types are available:



Global Painting

The **Raise**, **Lower**, **Rougher**, **Smoother**, **Warmer**, **Colder**, **Wetter**, and **Dryer** tools may be applied globally (i.e., so that they affect the entire world in one fell swoop) by holding  down, and left-clicking on the desired tool.

Selection Functions

FT provides a number of selection tools that can be used to mask portions of a world. When a selection mask is applied, all edits will only affect currently selected portions of a world. For example, if you paint a climate to the world, areas outside the current selection will not have their climates changed, even if the climate painting tool overlaps the selection's border.

When global painting, edits will be applied to all areas within the selection, and areas outside the selection will remain untouched.






Basic Selection Functions



Three basic functions are accessed from the **Select** menu. These are:

- ✓ **All** selects the entire world
- ✓ **Deselect** deselects all current selections
- ✓ **Inverse** inverts the current selection, so that everything currently selected is now de-selected, and everything that was outside the current selection becomes selected

Selection Tools

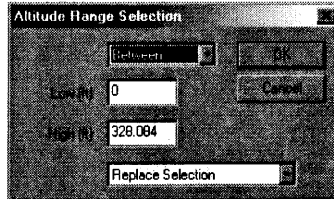
Four tools are provided which allow selection by shape. These tools can be found on the Selection Tools toolbar. Use **View menu >> Selection Tools** to display this toolbar.

- ✓ Click on the **Select Rectangle**  to create a rectangular selection. Left-click in the main window to place the rectangle's first corner, move the mouse, then left-click again to place the opposite corner when the preview displays the rectangle desired
- ✓ Click on the **Select Ellipse**  icon to create an elliptical selection. Left-click in the main window to start the selection, move the mouse, then left-click again to complete when the preview displays the ellipse required
- ✓ Click on the **Select Freehand**  icon to manually draw a selection mask. Left-click in the main window to start the selection. Draw the required selection by moving the mouse. Once the desired selection has been outlined, left-click to complete
- ✓ Click on the **Select Polygon**  icon to create a polygonal selection. Left-click in the main window to start the selection, then left-click to place further points as desired. To complete the selection, either triple-click (effectively clicking once to place the final point, then double-clicking in the same location to complete), or press 

These selection tools can also be used to add to or subtract from the current selection. Holding down  when completing the selection will add the area drawn to the current selection, and holding down  will remove the area drawn from the current selection.

Range Selection Functions

The **Select** menu provides four functions that are used to select portions of the world that conform to given parameters. With the exception of the **Climate Range** function, these tools prompt for the range required via a dialog box. The Altitude Range Selection dialog is shown below, to serve as an example:

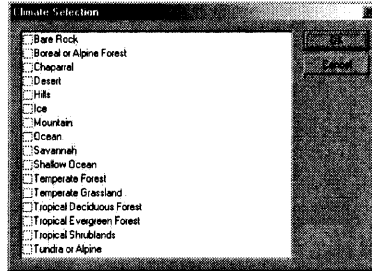


- ✓ **Low** and **High** form the range to be processed by the selection. For example, entering 0 in the **Low** box, and 500 in the **High** box when selecting by **Altitude Range** will consider all portions of the map that fall between 0' and 500' in altitude. Units differ for each range selection function (e.g., **Temperature Range** expects values in °F).
- ✓ The first drop-list determines how the selection relates to the given range: **Between** considers all portions between the **Low** and **High** values; **Not Between** considers those outside (either lower or higher) the given range; **Above** considers those portions of the world that are higher in respective value than the provided **High** value; and **Below** considers those portions that fall below the **Low** value.
- ✓ The lower drop-list determines how the selection is to be used: **Replace Selection** will clear the current selection, creating a new one based on the parameters given; **Add to Selection** will retain the current selection, adding to it according to the given parameters; **Subtract from Selection** will remove those portions conforming to the given parameters from the current selection.

The four range selection functions are:

- ✓ **Altitude Range** selects by altitude, in feet
- ✓ **Temperature Range** selects by temperature, in °F
- ✓ **Rainfall Range** selects by rainfall, in inches per year

- ✓ **Climate Range** selects by climate. This opens a dialog box (shown below) which lists all of the climates FT recognizes. Click on the boxes to the left of the listed climates to place or clear tick marks. A tick indicates that all regions conforming to that climate will be selected. Selecting by **Climate Range** always replaces the current selection



Selection Mask Modification

The current selection mask can be further modified:

- ✓ **Binarize** will “harden” the selection, so that each pixel is either fully selected or fully deselected. You will be prompted for a threshold value which will determine which pixels remain selected, and which will be deselected, depending on their current selection status. The range of this threshold is from 1 to 255. A value of 1 will fully select all pixels in the current selection, regardless of their partially selected state; a value of 255 will only consider those pixels that are already fully selected; a value of 127 will consider those pixels that are currently from 50% to 100% selected; and so on. Binarized selections cannot have partially selected pixels.
- ✓ **Feather** will “soften” the selection mask, blurring it around the edges. You will be prompted to enter the amount by which the selection is to be smoothed. Feathered selections can have partially selected pixels.
- ✓ **Modify >> Expand** will increase the size of the current selection by one pixel in all directions.
- ✓ **Modify >> Contract** will decrease the size of the current selection by one pixel in all directions.

Selection Mask Files

You can save selections for use in the future as selection mask files. A selection mask file is an 8-bit grayscale bitmap image that is the same size as the resolution set in **World Settings >> Advanced >> Editing Setup**. The grayscale color of each pixel is determined by the amount of the pixel currently selected: fully selected pixels will have an 8-bit

grayscale value of 255 (white); fully deselected pixels will have a value of 0 (black); partially selected pixels will be defined by shades of gray, depending on their selection status.

- ✓ Save Selection will save the current selection as a bitmap file
- ✓ Load Selection will prompt for the selection mask file to use, and will then apply that to the current world

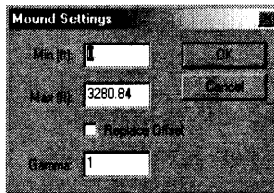
Mound

The **Mound** function takes parameters provided by the user, then adjusts the altitude values within a selection accordingly. It is useful for creating mountains, plateaus, etc.

To use the **Mound** function:

- 1 ➤ Use the selection functions and tools to select the area you wish to be affected.
- 2 ✓ Select **Tools menu >> Mound**.


You see the Mound Settings dialog box:



- ✓ **Min (ft)**: is the value that will be applied to the edge of the selection, in feet.
 - ✓ **Max (ft)**: is the value that will be applied to the center of the selection, in feet.
 - ✓ If **Replace Offset** is checked, the current values of the selection will be replaced by the **Mound** function. If unchecked, the **Mound** function will add to the current values.
 - ✓ **Gamma** indicates the linearity of the mound's slope. A value of 1.0 will produce a mound with fairly shallow-sloping sides. Values less than 1.0 will provide flatter tops and steeper sides. Values greater than 1.0 will produce shallower sides and more pointed center ridges.
- 3 ➤ Enter the parameters as required and press **OK**.
The **Mound** function will be applied to the selection.

Changing Color And Lighting Settings


At any time, you can change the current color and lighting settings used for your world. To do so:

- 1 ➤ Click on the **Lighting and Color** icon .
You see the Lighting and Color dialog box.
- 2 ➤ Alter color and lighting options to those desired.
This is performed in the same way as you did when creating your world.
- 3 ➤ Press **OK** to apply the changes.
FT will re-draw the world to reflect the new color and lighting settings.

Changing World Settings

You can change the currently used world settings. Note that, for synthetic worlds, changing world settings can alter the world. It is suggested that you save your world before changing its settings.

To change world settings:

- 1 ➤ Click on the **World Settings** icon .
You see the World Settings dialog box.
- 2 ➤ Alter the world settings to those desired.
This is performed in the same way as you did when creating your world.

Note that if the **Apply to Current World** box is not checked, you will lose any edits to the current world you have made.
- 3 ➤ Press **OK** to apply the changes.
FT will re-draw the world to reflect the new world settings if the **Apply to Current World** box was checked. Otherwise, the settings will be applied in blanket fashion.

SAVING AND EXPORTING

Once you have edited your world so that everything matches your desire, you may now wish to export it to an image file, a series of image files, or even to a VRML model.

Saving Your World

FT can save your world directly to four different file formats, these being:

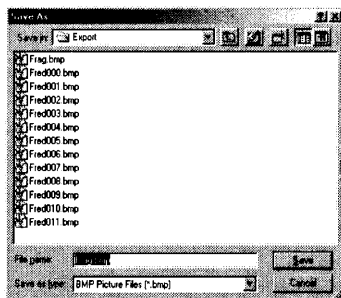
- ✓ FT native format (FTW)
- ✓ Bitmap image format (BMP)
- ✓ JPEG image format (JPG)
- ✓ Wilbur format (MDR)

You should always save your world in FT's own format, especially if you intend to use FT to further edit and refine it.

To save your world:

- 1 ✓ Select **File menu >> Save As**, or click on the **Save As** icon .

You will see the Save As dialog box:



- 2 ➤ Type a name for your world in the **File Name** box.
- 3 ➤ Select the format you desire from the **Save as type** drop-list.
- 4 ➤ Click on the **Save** button.

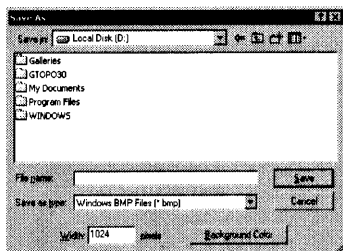
Exporting An Icosahedral Projection

Icosahedral projections are commonly used to depict worlds within science fiction role-playing games. Basically, an icosahedral projection takes the form of a flat-view exploded 20-sided shape.

To save your world as an icosahedral projection:

- 1 ▼ Select **File menu >> Export World >> Icosahedral.**

You will see the icosahedral Save As dialog box:



- 2 ➤ Change the **Width** value if desired.
The higher the **Width** setting, the larger the output file will be.
- 3 ➤ Click on the **Background Color** button.
You will see the standard Windows® color palette.
- 4 ➤ Choose the color you wish to use for the output file's background and click on **OK**.
The background color is used to fill the rectangular space within the image that is not occupied by the icosahedral projection.
- 5 ➤ Type a name for the file in the **File Name** box.
- 6 ➤ Select the desired file format from the drop-list.
Bitmap and JPEG formats are available for icosahedral export.
- 7 ➤ Click on the **Save** button.
FT will calculate and create the icosahedral image file.

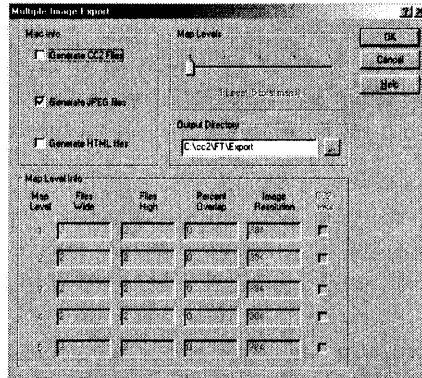
Exporting To Multiple Image Files

FT can output your world to several image files, each comprising a smaller, tiled section of the map. It is often useful to do this, since attempting to depict a detailed world map within a single image can result in an unmanageably huge file.

To export your world to several image files:

- 1 ▼ Select **File menu >> Export World >> Multiple Files**.

You will see the Multiple Image Export dialog box:




- 2 ➤ Check the **Generate JPEG files** box. Ensure that the **Generate CC2 Files** box is unchecked (this we shall cover later).

You can create HTML files linked to the generated JPEG images if you so desire by checking the **Generate HTML files** box. FT will generate hypertext links and navigation buttons linking the generated HTML files together.

- 3 ➤ Change the **Map Levels** and **Map Level Info** settings to those desired.

The **Map Levels** option is used to determine the number of image sets that will be created. The **Map Level Info** settings determines the form those levels take. Each map level set will comprise a number of images that tile together to form the whole world. For example, if two map levels are chosen, you will gain two separate depictions of the world, each comprising a set of image files. **Map Level Info** is set as per:

- ✓ **Map Level:** The map level to which the information row pertains.
- ✓ **Files Wide:** The number of files used to depict the world's horizontal axis at this level.
- ✓ **Files High:** The number of files used to depict the world's vertical axis at this level. The total number of maps that will be produced for the level is equal to the Files Wide value multiplied by the Files High value (i.e., a level set to 5 files wide by 2 files high will produce 10 images).

- ✓ **Percentage Overlap:** The extent to which each file of a given level overlaps with those adjacent to it.
 - ✓ **Image Resolution:** The pixel resolution of the resultant images. The higher this value is, the larger the resultant files will be.
- 4 ➤ Type the name of an existing directory to which the image files will be written in the **Output Directory** box, or click on the directory selection button  to select the directory from a dialog box.
 - 5 ➤ Click on **OK** to start the export.

FT will generate the files to the specifications you have set, and an overview file depicting the entire world. This process may take some time, depending on the number and nature of levels you have chosen.

The files will have a filename consisting of a letter and a number. The letter refers to the map level (the overview map will be “A”, level one will be “B”, and so on). The number refers to the row and column of the map’s tile.

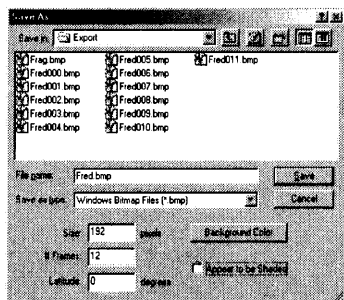
Exporting A Spin View

A spin view is a series of image files that depict the globe in a period of rotation. These files may be then combined to form a “rotating globe” animation, or can simply be used on their own merit.

To export your world to a spin view:

- 1 ✓ Select **File menu >> Export World >> Spin View**.

You will see the Spin View Export dialog box:



- 2 ➤ Set up the export parameters desired.

For spin view exports, the parameters are:

- ✓ **Size:** The size of each frame in pixels. The higher this value is, the larger the output files will be.
- ✓ **# Frames:** The number of images that will be created. Each image depicts the world at a different stage in its period of

rotation. If used for animation, the higher this value is the smoother the resultant animation will be.

- ✓ **Latitude:** The degree of latitude that will form the center point of the rotational view.
- ✓ **Appear to be Shaded:** Check this box if you wish the views to appear shaded:



Unchecked



Checked

- 3 ➤ Type a name for the file in the **File Name** box.
- 4 ➤ Select the desired file format from the drop-list.
Bitmap and JPEG formats are available for spin view export.
- 5 ➤ Click on the **Save** button.
FT will calculate and create the spin view image files. Each file will consist of the selected filename, plus a numerical suffix indicating where in the rotational sequence the file occurs.

FT does not export directly to a spin view animation because of the additional licensing costs involved. There are several software packages that allow individual files, such as those created by FT's spin view export function, to be tied together in a single animation file, including:

ImageReady, from Adobe® (www.adobe.com)

Animation Shop, from Jasc (www.jasc.com)

Ulead GIF Animator, from Ulead (www.ulead.com)

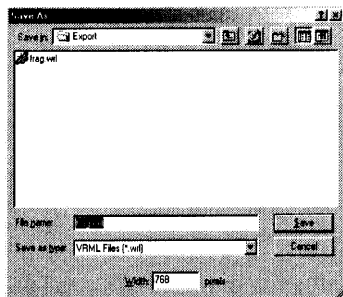
Exporting To VRML

VRML (Virtual Reality Modeling Language) is a modeling language that can be used to depict interactive 3D objects and environments. To use a VRML file, you will need a viewer capable of understanding the language (there are many such viewers available, including plug-ins for Internet browsers).

To export your world to a VRML file:

- 1 ▼ Select **File menu >> Export World >> VRML**.

You will see the VRML Save As dialog box:



- 2 ➤ Set the desired width for the output file.

The greater the width, the higher the resolution of the resultant model, but the larger the file size.

- 3 ➤ Type a name for the file in the **File Name** box.



- 4 ◀ Click on the **Save** button.

FT will calculate and create the VRML file. To view the file, open it with a VRML viewer. The appearance will depend on the viewer used.

Exporting to Bryce2 and Bryce3D

FT does not support map exports to Bryce2 or Bryce3D formats.

However, Wilbur does. It is therefore possible to export a map from FT into a format Wilbur can use, and then to use Wilbur to export the results to Bryce.

Wilbur is provided on the FT CD, along with user documentation.

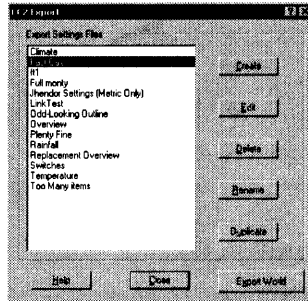
EXPORTING TO CC2

CC2 is a powerful cartographical tool that can be used to further enhance and manipulate your world. Before you can do so, you must first export the world to one or more CC2 map files.

FT To CC2 Export Options

Whenever you export worlds from FT to CC2 maps, you will be presented with a series of options that will determine what will comprise the resultant CC2 map file. Once you have determined these options, they may be saved for future use. You must create and save options before you can use them to export to CC2 files.


When you must choose CC2 export options, you will see the CC2 Export dialog box:



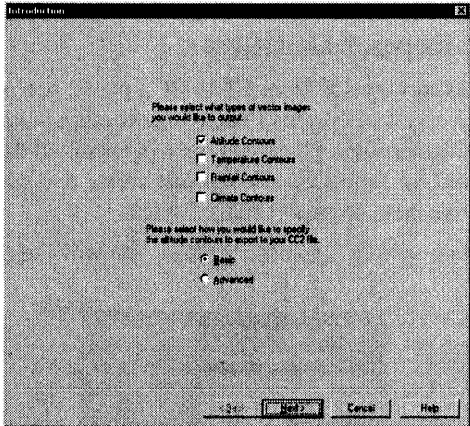
Available export settings files will appear in the list. Other features of the dialog box are:

- ✓ **Create:** Clicking on this button will start the CC2 Export Filter wizard (see below).
- ✓ **Edit:** This will start the CC2 Export Filter wizard, using the currently selected export options file. Changes you make to the settings during the course of the wizard will be saved to this file.
- ✓ **Delete:** Deletes the currently selected export file.
- ✓ **Rename:** Allows you to rename the currently selected export file.
- ✓ **Duplicate:** This creates a duplicate of the currently selected export file. The duplicate file will default to a “Copy of..” filename. You can then use the Rename function to change this.
- ✓ **Export World:** This will export the current world, using the options set within the currently selected export file.

To create a new CC2 export file:

- 1  Click on the **Create** button.

You will see the CC2 Export Filter wizard's introductory dialog box.



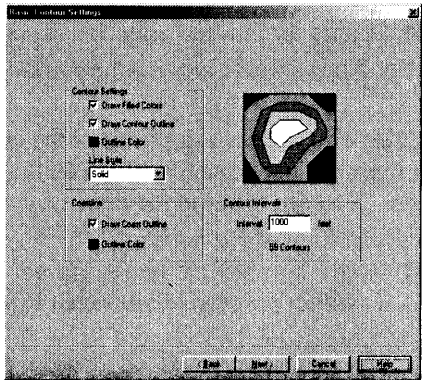
- 2  Check the export options you require.

The checkboxes indicate which parts of the FT world data you wish to export to CC2. Each information level will be written to a separate CC2 drawing layer.

The **Basic/Advanced** radio button option is used to determine the options you will be presented with respect to contour output. The **Basic** option will provide a simple set of options. If you need to use non-standard contours, contour labeling, etc., then choose the **Advanced** option.

- 3  Click **Next**, and choose the settings you desire for contour output.

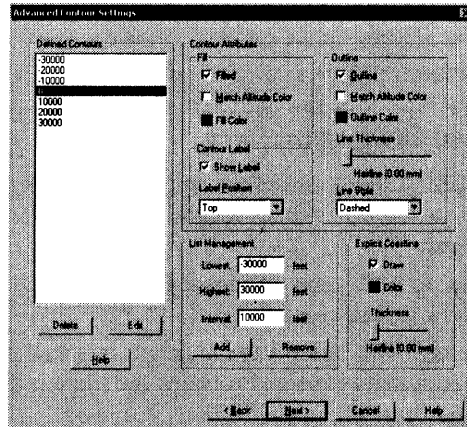
If you opted for Basic contour options, you will be presented with the Basic Contour Settings dialog box:



- ✓ **Draw Filled Contour:** Selecting this option will create solid-filled contour entities.
- ✓ **Draw Contour Outline:** Selecting this option will draw an outline around each contour.
- ✓ **Contour Outline Color:** Clicking on this color box will bring up the CC2 Color Picker, from which you may select the color to use for contour outlines.
- ✓ **Line Style:** Change this option to use a different line style for contour outlines.
- ✓ **Draw Coast Outline:** Selecting this option will draw an outline around the world's coasts.
- ✓ **Coastline Outline Color:** Clicking on this color box will bring up the CC2 Color Picker, from which you may select the color to use for coastal outlines.
- ✓ **Contour Intervals:** This setting will determine how many contours will be drawn, and the altitude represented by each. The lower this value, the higher the number of altitude contours that will be produced.

The thumbnail view will provide a simple overview of the options you have selected.

If you opted for Advanced contour options, you will be presented with the Advanced Contour Settings dialog box:



Contour Attributes > Fill options are:

- ✓ **Filled:** Selecting this option will create contours with a solid fill style.

- ✓ **Match Altitude Color:** Select this option to use the colors set for this world when creating the CC2 file. Uncheck it to choose another color.
- ✓ **Fill Color:** If **Match Altitude Color** is not selected, then you can click on this color box to choose the contour color you wish to use.

Contour Attributes > Outline options are:

- ✓ **Outline:** Check this to produce contour outlines in the resultant CC2 map.
- ✓ **Match Altitude Color:** Uncheck this box to use a color other than those set for the world when creating contour outlines.
- ✓ **Outline Color:** If **Match Altitude Color** is not selected, you can click on this color box to set outline color.
- ✓ **Line Width:** Adjust this slider bar to achieve the line width you wish to use for contour outlines in the CC2 map.
- ✓ **Line Style:** Choose a line style for contour outlines from this drop list.

Contour Attributes > Contour Label options are:

- ✓ **Show Label:** Select this box to produce a text label for each contour. For very rough worlds, this may cause your CC2 output to be smothered in text.
- ✓ **Label Position:** Use this drop list to set the desired position for contour labels, in relation to the contours.

The **List Management** section allows you to define which contours will be drawn in the CC2 map. The options here affect the **Defined Contours** list:

- ✓ **Lowest:** This value defines the lowest height for which a contour will be created. Negative values refer to sea depth contours.
- ✓ **Highest:** This value defines the highest height for which a contour will be created.
- ✓ **Interval:** This value sets the height intervals at which contours will be created between the highest and lowest settings.
- ✓ **Add:** Clicking on this button will create a contour list within the **Defined Contours** section based on your chosen settings.
- ✓ **Remove:** Clicking on this button will remove the whole **Defined Contours** list.

The **Defined Contours** section will display the contours currently set for the export. You can manipulate the list using the **List**

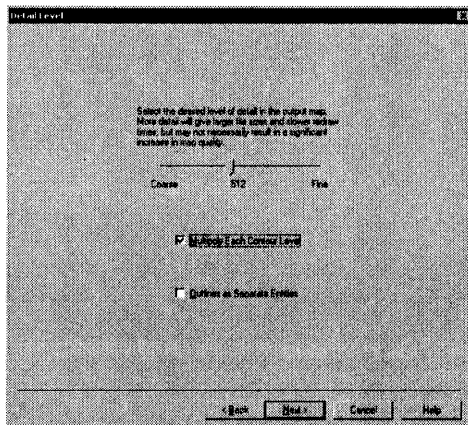
Management section, or by selecting one or more contours from the list and then clicking on **Edit** or **Delete**:

- ✓ Clicking on the **Edit** button will allow you to individually set **Contour Attributes** (see above) for the selected contours.
- ✓ Clicking on the **Delete** button will remove the selected contours from the list.

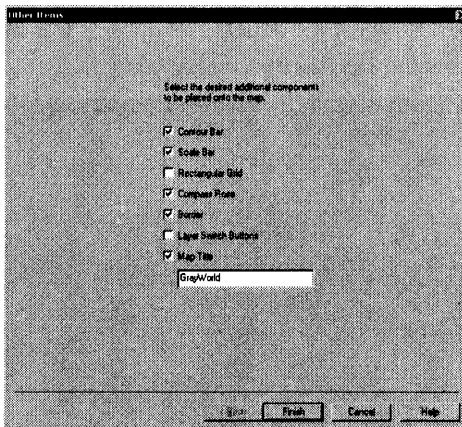
A word of advice and warning: The more contours you define, the larger the CC2 output file will be. The potential exists to produce very large output files indeed. The larger a file, the longer CC2 will take to load and redraw the map. Depending on your system's resources, CC2 may not even be able to open the file in question. We have discovered that a 500MHz machine with 128Mb RAM and a 32Mb graphics card takes around half an hour to load and draw a world map exported from FT of around 50Mb. To be reasonably useable, you should aim to produce output files of 10Mb or less. If this does not provide the level of contour detail you require, consider using the Multiple File export function to split your world up across more than one CC2 map.

The **Explicit Coastline** options are:

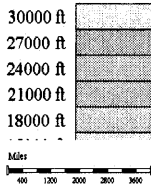
- ✓ **Draw:** Select this box to include a coastline outline with the map.
 - ✓ **Color:** Click on this color box to select the color you wish to use for the coastline.
 - ✓ **Thickness:** Use this slider bar to select the line thickness you wish to use for the coastline.
- 4 ✓ Click **Next**, and select the detail level options you wish to use.
You will see the Detail Level dialog box:



- ✓ The slider bar is used to set the level of detail within the resultant CC2 map. Coarse maps may appear blocky when zoomed in, and are suitable for world overviews. Fine maps will appear more realistic, but will create larger sized files and are thus only suitable for local area views (created using the Multiple Files export, see below).
 - ✓ **Multipoly Each Contour Level:** Selecting this option will multiply all contours of a given level together into a single entity. This will provide greater accuracy, but will slow down load and re-draw times.
 - ✓ **Outlines as Separate Entities:** By selecting this option, the solid-fill and outlined contour components will be separated into individual entities. If this is unchecked, contour outlines will be created by using the second color functionality of CC2 - contour and outline will be defined within a single entity. Since entities that use this function are selected by their outline colors, this can cause problems when editing a map (in effect, all contours with the same outline color will be treated as if they were the same overall color). Checking **Outlines as Separate Entities** will eliminate this problem, but will double the number of contour entities created, thus slowing re-draw and load times down and increasing the output file size.
- 5 ▼ Click **Next**, and select other items you wish to include in your map. You will see the Other Items dialog box:



The items selected here will be drawn into the CC2 map. The possible items are:



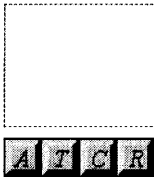
Contour bars show the meaning of individual colors for a given information set. A separate contour bar will be added for each information level you have chosen to create.

Scale bars show actual distances represented by a smaller, scaled distances on a map.

If you opt to include a grid, you will be presented with the Grid Settings dialog box. The grid will be drawn to the settings you choose.



A compass rose shows in which direction north lies. When outputting multiple, linked maps, the compass rose will include links to other files created. Clicking on one of the compass points will load the map that lies in the selected direction at the current map's level. Clicking in the center of the rose will load the next lowest level map.



Selecting the Border check box will produce a map border in the output file.



Layer switch buttons allow you to navigate easily between the different information levels you have selected to create, along with their respective scale bars. Click on "A" for Altitude, "T" for Temperature, "C" for Climate, and "R" for Rainfall.

The Title check box will produce a cartouche containing text entered into the edit box.

6 ➤ Click Finish.

The Finish button may actually appear on the Grid Settings dialog box if you have opted to include a grid. If so, click **Next** to go to the Grid Settings dialog, choose the options you wish, and then click **Finish**.

7 ➤ Enter a name for your CC2 export file, and click on OK.

You will be returned to the CC2 Export dialog box.

- 8 ➤ To export your world to CC2, select the export file you wish to use and click **Export World**.

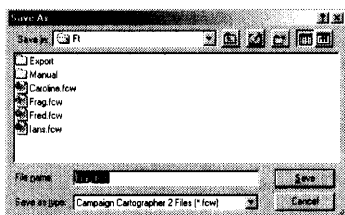
FT will now calculate and create the CC2 file (or files) to your chosen specifications. Note that this may take some time, depending on the options you have set in the CC2 export file.

Exporting To A Single CC2 Map

To export your world to a single CC2 file:

- 1 ➤ Choose **File menu >> Save CC2 File**.
You will see the CC2 Export dialog box.
- 2 ✓ Select the desired export file, or create a new one, and press **Export World**.

You will see the Save As dialog box:




- 3 ➤ Give the file a name, and press **Save**.
FT will now create your CC2 file.

This command saves the current FT view to CC2. Thus, to produce a CC2 map covering a small area of your world, just zoom into the area required and follow the steps above.

Exporting To Multiple CC2 Maps

Just as you can export worlds to multiple tiled image files, you can export them to multiple CC2 maps. The procedure is virtually the same as that for multiple image exports:

- 1 ➤ Choose **File menu >> Export World >> Multiple Files**.
The Multiple Image Export dialog box will appear.
- 2 ➤ Click to check the **Generate CC2 Files** box.
You can also check the **JPEG** and **HTML** options to simultaneously export your map to all three formats.
- 3 ➤ Set map level options as desired.
These are the same as per multiple image file export (see above). However, one further **Map Level Info** option becomes available:

- ✓ Check the **CC2 Links** box to compass rose and map links between the generated maps.
 - 4 ➤ Type the name of an existing directory to which the map files will be written in the **Output Directory** box, or click on the directory selection button  to select the directory from a dialog box.
 - 5 ➤ Click on **OK** to start the export.
- FT will generate map files to the specifications you have set, and an overview map depicting the entire world. As with multiple image exports, this process may take some time depending on the CC2 export options set.

Standard CC2 layers for FT exports

When FT exports a map to CC2, it places entities on particular layers:

Entities	Layer	Entities	Layer
Climate contours	CLIMATE	Climate contour bar	CBAR CLIMATE
Rainfall contours	RAINFALL	Rainfall contour bar	CBAR RAINFALL
Temp. contours	TEMPERATURE	Temp. contour bar	CBAR TEMPERATURE
Altitude contours	RELIEF/CONTOURS	Climate contour bar	CBAR CLIMATE
Contour outlines	CONTOUR OUTLINES	Map title	MAP BORDER
Altitude labels	User selected layer	Map border	SCALE BAR
Coast outline	COAST/SEA	Layer buttons	MAP BORDER
Grid	HEX/SQUARE GRID	Compass rose	MAP BORDER
Scale bar	SCALE BAR	Links	MAP LINKS

Importing CC2 maps with Wilbur

While FT cannot import maps drawn using CC2, it can import binary files. While a future issue of FT may address CC2 to FT imports more fully, basic contour information can be transported from CC2, through Wilbur, and into FT by following this procedure:

- 1 ➤ In CC2, hide all layers but a specific contour level (or hide everything except the entities you wish to use at a specific altitude level)
- 2 ➤ Use **File >> Save As**, change the file type to PNG and the file size to one unique to the contour level, and press **OK** to save the map
- 3 ➤ Repeat the above two steps for each contour level required
- 4 ➤ Make a note of the file size used for output, either via **Edit >> Clipboard >> Options**, or by typing **JPEGOPT** at the command line
- 5 ➤ Load the lowest level contour image into an image editing package, such as *Adobe® Photoshop*, or *PaintShop Pro*
- 6 ➤ Change the image to grayscale

- 7 ➤ Change the color of the contour concerned to a distinct shade of gray. For the lowest contour level (the coastline), use a near-black shade (black should be used to represent the sea). Increments of 10, on the 0-255 scale, work well
- 8 ➤ Copy the resultant contour (not the entire image) into a new image of the same size
- 9 ➤ Repeat the above process for each of the contour images, until all contours are present in the new image
- 10 ➤ Save the final image as a 256-color Windows® bitmap file
- 11 ➤ Use Wilbur to open the bitmap as a surface (**File >> Open: 8-bit BMP Surface**)
- 12 ➤ Scale the altitudes to the desired level (**Surface >> Point Process >> Scale: To Range**)
- 13 ➤ Use **File >> Save As** to save the file to Muse DTED format (a 16-bit binary format)
- 14 ➤ In FT, use **File >> New**, check the **Binary File** radio button, and press **Next**
- 15 ➤ Click the **Choose Elevation File** button
- 16 ➤ In the Binary Data parameters dialog, select the Muse DTE file you created with Wilbur, set the Per-sample information to 2-byte, LSB First, Signed, Header Length = 1024, Line Width to the width of the image ×2, Width and Height to the width and height of the image, and Map Edges to the locations on the globe where you want the map to be placed
- 17 ➤ Click **OK**, then **Finish**, to produce the map

This process is not perfect, and a certain degree of editing will be necessary to achieve the results you require.

There are several methods by which this process can be made more efficient. For example, using a grayscale contour scheme in CC2 (or by translating a color contour scheme to grayscale, by means of a macro for instance) can eliminate the image editing and building steps between CC2 output and Wilbur.

Wilbur is included on the FT CD. More information about this program can be found within its own documentation (also provided on the CD) and on the Wilbur website (www.ridgenet.net/~jslayton/software.html).

More information about importing binary files into FT can be found in the next chapter, "*Creating Worlds From Binary Files*".

Importing maps using Selection Mask Files

This process can be used to import continental shapes from existing maps that have been drawn using CC2 or a paint program. It is not as precise, in terms of contours, as the method detailed above, but it is much easier to use.

- 1 ➤ Create an 8-bit grayscale bitmap of your world.


The bitmap should range from black (grayscale color value 0) for regions which are wholly water-filled, to white for regions that are wholly inland. Using only black and white is possible, which will result in fairly chunky coastlines which can later be edited within FT for a nicer effect.

The image size should be twice as wide as it is high (in pixels), and its dimensions should be divisible by 4. As a suggested recommendation, an image size of 1024×512 works well.

You should also bear in mind that this process uses an equirectangular projection, so land distortions should be accounted for.

- 2 ➤ Start FT.


If you have the **Reload last world file on startup** preference option set, you may wish to start a new synthetic world before proceeding.

- 3 ➤ Change the **World Settings** icon  >> **Advanced** >> **Editing Setup** so that the size (shown in the **Custom** edit box) equals the width of your grayscale bitmap.

If you're using the recommended 1024×512 image size, selecting the **Large Editing Setup** will provide this. Otherwise, you may have to choose **Custom**, and manually enter the required value.

- 4 ➤ Uncheck the **Continental Shelves** box, and press **OK**.
- 5 ➤ Enter 5000 in the **Highest Peak** box, and -20000 for the **Lowest Depth**, then press **OK**.
- 6 ➤ Select **Tools** menu >> **Global Set** >> **Land Offset**, and use a value of -5000 to bring the land below the sea.
- 7 ➤ Select **Select** menu >> **Load Selection**, and choose the grayscale bitmap you have created for your world.

The bitmap will be loaded as a selection mask. You will now see your continents outlined on the world by selection boxes.

- 8 ➤ If desired, smooth the edges of the selection by using **Select menu >> Feather**.
A value of 1.0 or less will produce good results.
- 9 ➤ If additional land roughness is desired, select **Tools menu >> Global Set >> Land Roughness** with a value of 3 to 8.
- 10 ➤ Select **Tools menu >> Global Set >> Altitude**, with a value of 0.
Your continents will now be roughly at sea level.
- 11 ➤ Select **Tools menu >> Global Smooth**, using a value of 5 to eliminate some of the extremes of roughness in the landscape.
- 12 ➤ Raise the land to bring most of the continents above sea level.
- 13 ➤ Edit the world to place mountain ranges and other features.
Using the **Tools menu >> Mound** function with **Min/Max** values of 0/3000, a **Gamma** of around 4, and **Replace Offset** unchecked, with mountain range areas sketched out using the **Select Freehand** tool  can produce some good mountain range effects.

CREATING WORLDS FROM BINARY FILES

As well as being able to create worlds from scratch, FT has the ability to import binary data files that define sections of terrain. You will find examples of such files, from the GTOPO30 real-world data sets, that you can import into FT to produce maps based on Earth.

Note that the binary file used must be present for as long as you intend to use the world file. FT does not import the binary data into its own format, but rather uses the binary file for reference. Moving or deleting the binary file after saving a world created with it will result in the world file being unusable. This can be avoided by using the Burn In To Surface function, which is further detailed below.

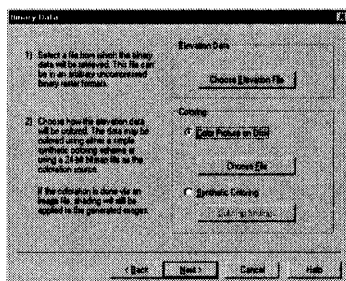
To create a world from a binary file:

- 1 ➤ Select **File Menu >> New**.

You see the Select World Type dialog box:

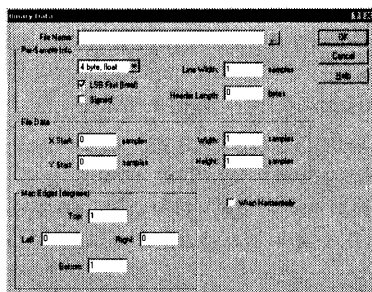
- 2 ✓ Check the **Binary File** radio button, and click on **Next**.


You see the first Binary Data wizard dialog box:



- 3 ✓ Click on the **Choose Elevation File** button.

You see the Binary Data parameters dialog box:



- 4 ➤ Click  to select the required file from a dialog box. Select the file *ETOP05.bin* in the *Terrain Data* folder.

If the selected file has an associated description, you will be prompted as to whether you wish to use this or not.

For the most part, the settings on this dialog box will be determined by the binary file selected.

- 5 ➤ Press **OK** to return to the Binary Data wizard.

- 6 ➤ Select the **Synthetic Coloring** radio button.

This will use the color settings FT uses by default when creating synthetic worlds.

- 7 ➤ Click **Next**.

A summary of the map to be generated will appear.

- 8 ▼ Click **Finish** to start generation.

FT will calculate the new map, and display it in the main window.



In most cases it is better to copy data files onto your hard drive before using them to make maps, as this improves the speed of FT.

Burn In To Surface

This function takes the current world information, and “burns” it into the surface. This removes FT’s reliance on binary data files; in effect, the binary data is converted into FT’s native format.

As a side-effect, the **Burn To Surface** function removes most of the contribution of the fractal basis function, resulting in a smoother map. This makes the function useful for worlds that do not use binary files (e.g., when a surface has been roughened, using the **Burn To Surface**

command will set the roughen channel to 1.0 (the default), and transfer all altitude adjustment to the land offset channel).

Once the **Burn In To Surface** function has been utilized, it cannot be undone.

To use the **Burn In To Surface** function, select **Tools menu >> Burn In To Surface**. Since the function cannot be undone, FT will prompt you to make sure you wish to proceed.

FLAT WORLDS

If you want to manually draw land patterns, rather than allowing FT to randomly generate them for you, you can create a new world that possesses a flat, featureless terrain.

Using a flat world as a starting point, you can then use the editing tools to paint terrain features as you wish.

To start a new flat world:

- 1 ➤ Select **File Menu >> New**.
You see the Select World Type dialog box:
- 2 ➤ Check the **Flat World** radio button, and click on **Next**.
You see the Synthetic World dialog box.
Because some of FT's editing tools require fractal information, flat worlds use the same underlying setup as do synthetic worlds.
- 3 ➤ Click on the **Generation Settings** button, and set desired options.
- 4 ➤ Click on the **Coloring Settings** button, and set desired options.
Steps (3) and (4) are performed in exactly the same way as for synthetic worlds. See the *Your First World* tutorial.
- 5 ➤ From the Synthetic World dialog, Click on **Next**.
You see summary of the world you are to produce.
- 6 ➤ Click on **Finish** to complete generation setup.
FT will calculate and draw the flat world.
- 7 ➤ Select **Tools menu >> Global Set >> Global Raise**, type **1000** and press **OK**.
FT has raised the height all over the globe.

Because of the way the raise and lower tools work, it's better to start with a raised surface and use the lower tools to make seas than vice versa.

The world may now be edited as you see fit using FT's editing tools. See the *Editing Your World* tutorial for guidelines.

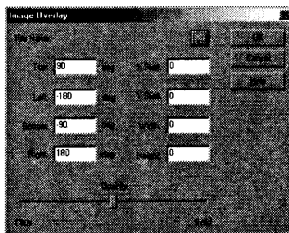
INSERTING OVERLAY IMAGES


You can insert image files as overlays in FT for use as guides when editing. Such images do not form part of the map, and are not saved with the world file. They simply serve as templates to aid your work.

To insert an overlay image:

- 1 ✓ Select Map menu >> Overlay Image.

You see the Image Overlay dialog box:



- ✓ File Name is the image file to use.
 - ✓ Top, Left, Bottom, and Right are the edges of the area that will be occupied by the image. Top and Bottom are latitudes, Left and Right are longitudes.
 - ✓ X Start, Y Start, Width, and Height indicate the area of the image to be used in the overlay, as pixel references.
 - ✓ The Opacity slider controls the transparency of the image, as it will appear in the main window. Moving the slider towards the Clear end of the slider makes the image more transparent, allowing the world below the image to be more clearly seen. Moving the slider towards the Solid end has the opposite effect.
- 2 ➤ Click , and select the image file desired.

The types of image file that may be selected is dependent on whether MicroSoft Internet Explorer® 4.0 or higher is installed on your system. If it is, you may select BMP, GIF, JPEG, or PNG files. If it is not, you are limited to BMP files alone.
 - 3 ➤ Enter parameters into the Image Overlay dialog box according to the parameters of the image selected, and your requirements.
 - 4 ➤ Press OK.

The image will appear as an overlay in the main window.

Since the image is not saved with the world file, removing it is simply a case of re-loading the world once your edits have been saved.

REFERENCE

Within the tutorials, you have been introduced to all of FT's component parts. Within this chapter, we shall discuss the more advanced features of the package, and will explore some of FT's features which you have already met in more detail.

Theory

FT does a lot of very peculiar things internally and it may help the understanding of what the tools do if you have an understanding of what the program does.

The Elements

A map is composed of a number of elements that the user normally doesn't think about. A user's view of the world is that it has an altitude, a temperature, a rainfall value, and a climate derived from the two. The program uses a number of other values in its work, however. For instance, the altitude is composed of many different components working together (the fractal basis function, internal scaling and offset factors, user-defined scaling and offset factors, and continental shelves) to get the final altitude value at a point. The temperature and rainfall similarly have user-defined scaling factors and offsets, as well as a fractal basis function.

Fractal basis function

The heart of FT is the fractal basis function – *fractal()*. In essence, this is a mathematical entity evaluated in 3D space (the surface of the sphere).

The magnitude of the function is used as the basic altitude. FT includes two different basis functions: Ridged Multifractal; and Brownian Noise. They look somewhat different in terms of their final output, but they are treated in the same manner internally.

When a new world is generated, FT evaluates the fractal basis function over the sphere. From the results of this calculation, it figures out what the minimum and maximum values are, as well as scale and offset factors required to get the desired percentage of water and min/max values. All the user ever sees of this is the min/max values, percentage sea slider, and choice of basis function.

Because the initial surface evaluation is rather coarse, it is possible that true min/max values won't be found and the surface can exceed the defined min/max values. The derived scaling and offset values (*fsea* and *fscale*) are used to convert the raw basis function value (typically in the range of 0.2 to 1.5 for the Ridged Multi-fractal model) into the user-defined min/max range.

Offsets

The land **Raise/Lower** tools work directly on the user-defined offset value. The values are painted directly into the offset map. One simple addition, and that's all there is to it.

Scaling

The land **Roughen/Smooth** tools work on the user-defined scaling value. The values are painted directly into the offset map. One final multiplication is all it contributes.

The roughening effect comes about because it is scaling the fractal basis function. Unfortunately, this can also result in very high altitudes - it can tame a world with interesting contours that are just a bit too high. Just set the scaling factor to values less than 1, and the mountains will drop.

Continental Shelves

The continental shelves are an exponential post-process applied to the altitude values. The raw altitude gets offset downward by the amount of the continental shelf level, then an exponent of approximately 2 (or 0.5 in the case of terrain below the shelf level) is applied. After re-scaling to the correct min/max values, the final value is ready for the user-defined offset and scale.

The location of the exponent has some consequences. Offsetting the land doesn't change the presence of the continental shelf or keep it at a constant depth underwater. It would have to come after the user adjustments to do that. It also causes the scaling to be just a hair off, which results in dramatic shifts in the coastlines. Setting the level to 0 will preserve the coastlines at the cost of having very steep ocean dropoffs.

Water Level

The **Water Level** tool works together with the altitude calculation to determine where the water is in the world. If the water level at a given point is higher than the altitude, the coloration will use the water rules. Otherwise it will use the land rules.

The default water level is 0.0, but it can be locally changed to get lakes or dry areas.

The user tools simply paint values into the map.

Rainfall

Rainfall is computed according to the following functions:

$$rain = |fBm(lat, lon)| \cdot random + rbase$$

$$rain = rain \cdot \frac{temperature(lat, lon) + 30}{60}$$

$$rain = rain + \frac{altitude(lat, lon)}{1000} + uvalue(lat, lon)$$

Where:

random is Random from the rainfall model

rbase is the Base value

uvalue() is the user-defined rainfall value at that point

fBm is the basic Brownian Noise fractal type

Temperature **temperature** and **altitude** are the functions described below

Temperature

Temperature is computed according to the following function:

$$temp_1 = 374 \cdot greenhouse \cdot (1 - albedo) \cdot \sqrt[4]{light}$$

$$temp_2 = temp_1 - 0.8 \cdot tscale + tscale \cdot insolation(axistilt, lat)$$

$$temp_3 = temp_2 - 0.006491 \cdot altitude(lat, lon)$$

$$temp = temp_3 + random * fBm(lat, lon)$$

Where:

temp is the final temperature in Kelvin

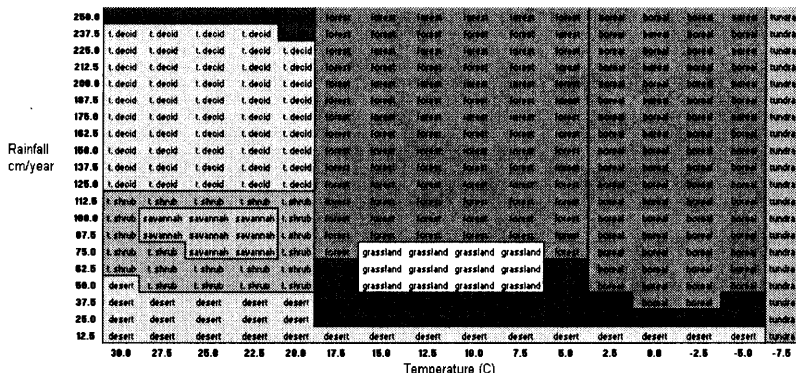
greenhouse, **albedo**, **light**, and **axistilt** are the values entered by the user in the temperature model

tscale is the same as Variance

random is the Random model value

fBm is one of those pesky fractal basis functions again

Climate is computed directly from rainfall and temperature according to the following table:



Nothing fancy or peculiar, just a straight table lookup.

Climate Considerations & Descriptions

Bare Rock: This climate type is self-descriptive. Very little in the way of vegetation exists in these regions, other than hardy low-level plants, lichens, and so forth.

Boreal: Cold forests, usually of spruce and fir. Standing surface water is common in such regions, and bogs form in areas of saturation.

Chaparral: Low, scrubby brush and grassland. Similar to the hilly regions of California, and certain areas of Australia.

Desert: Regions which see very little annual precipitation. It is low rainfall, not temperature, that defines desert - desert areas on Earth are as diverse as the frozen wastes of Antarctica to the sandy expanses of the Sahara. Because FT's rainfall model does not take into account factors such as weather patterns when computing rainfall, deserts will appear rarely within generated worlds. As such, if desert regions are required, they must usually be painted on by the user.

Grassland: Similar to the North American Great Plains - expanses of grassland with little in the way of large vegetation except along river courses etc. Annual rainfall is not high enough to support forests and so forth.

Hills & Mountains: Regions of altitude variance; self-explanatory.

Ice: Ice caps and so forth. Similar to the regional ice coverage of the Arctic and Antarctic.

Savannah: Tropical grassland, similar to that found within the African plains.

Temperate Forest: Forestland of a type commonly found across North America and Europe. They may be deciduous, evergreen, or of mixed composition.

Tropical Deciduous Forest: Similar to the coastal forests of South America, marked by large annual rainfalls interspersed with dry seasons, at a relatively constant temperature.

Tropical Evergreen Forest: Similar to the rain forests of equatorial Africa and the Amazon basin. Consistently high rainfall levels and little temperature fluctuation.







Tundra: Treeless areas with scattered, low-lying vegetation. Tundra freezes hard during winter, and is subject to permafrost for much of the rest of the year.
















FT's Interface


















The FT interface consists of a main window (in which the world will be drawn, and most of your work will be done), and several ancillary toolbars and windows. These latter may be dragged onto and off the main window, just as standard Windows® floating toolbars. The main window may be resized, maximized, and minimized. World re-draws are affected by the size of the main window, and can be quite slow when maximized.

Icons, Menus and Shortcuts









The following summarizes FT's menus, icons, and keyboard shortcuts.

Item	Icon	Shortcut	Function
File menu			
New			Start a new world
Open			Open an existing world
Save			Save the current world
Save As			Save the current world to a different file (including image file formats)
Save CC2 File			Save the current world to a CC2 file
Revert to Save			Discard all edits in favor of last saved version of this world
Export World >> Icosahedral			Export world to an icosahedral projection

Multiple Files			Export world to multiple tiled images and/or CC2 files
Spin View			Export world to images representing a rotational period
VRML			Export world to a VRML model
Revert to Saved			Revert to the saved version of the current world
Print			Prints the current view of the world
Print Setup			Access the standard print setup for your printer
Print Preview			Opens a standard Windows® Print Preview window, showing what the Print command will output
1, 2, etc. Exit			Open previously viewed files Quit FT
Edit menu			
Undo			Undo the last command
Redo			Redo the last command
Preferences			Set FT function preferences
Map menu			
Change Projection			Change the map projection used to display the world
Lighting and Color			Change the color and lighting settings for the world
World Settings			Change the current world settings
Background			Change the color and fill used for the world view window's background
Grid Settings			Change the grid settings
Show Altitude			Change view to show altitude contours
Show Climate			Change view to show climate contours
Show Rainfall			Change view to show rainfall contours
Show Temperature			Change view to show temperature contours

Next World			Draw world using the next sequential seed number. Current edits will be lost
Previous World			Draw world using the previous sequential seed number. Current edits will be lost
Overlay Image			Insert an overlay image to guide editing
Regenerate			Force FT to regenerate the current world
<hr/>			
Tools menu			
Settings			Change values and options used for edit tools
Paint Values >>			
Climate			Paint currently selected climate type (see Climate Selector)
Land Offset			Paint the currently set Raise/Lower value
Land Roughness			Paint the currently set Roughness value
Rainfall			Paint the currently set Rainfall value
Temperature			Paint the currently set Temperature value
Water Level			Paint the currently set Water value.  and left-click to choose an altitude value to use from the world
Paint Raise >>			
Land Offset			Raise the painted area by the currently set Raise/Lower value
Land Roughness			Increase the roughness of the painted area by the currently set Roughness value
Rainfall			Increase the rainfall of the painted area by the currently set Rainfall value
Temperature			Increase the temperature of the painted area by the current Temperature value









Paint Lower >>

















Land Offset			Lower the painted area by the currently set Raise/Lower value
Land Roughness			Decrease the roughness of the painted area by the currently set Roughness value
Rainfall			Decrease the rainfall of the painted area by the currently set Rainfall value
Temperature			Decrease the temperature of the painted area by the currently set Temperature value

Global Set >>

Altitude			
Land Offset			Set the altitude of the whole world to the currently set Raise/Lower value
Land Roughness			Set the roughness of the whole world to the currently set Roughness value
Rainfall			Set the rainfall of the whole world to the currently set Rainfall value
Temperature			Set the temperature of the whole world to the currently set Temperature value
Water Level			Set the water level of the whole world to the currently set Water Level altitude

Global Raise >>

Land Offset			Raise the altitude of the whole world by the currently set Raise/Lower value
Land Roughness			Increase the roughness of the whole world by the currently set Roughness value
Rainfall			Increase the rainfall of the whole world by the currently set Rainfall value
Temperature			Increase the temperature of the whole world by the current Temperature value

Water Level			Increase the water level of the whole world by the currently set Water Level value
Global Lower >>			
Land Offset			Lower the altitude of the whole world by the currently set Raise/Lower value
Land Roughness			Decrease the roughness of the whole world by the currently set Roughness value
Rainfall			Decrease the rainfall of the whole world by the currently set Rainfall value
Temperature			Decrease the temperature of the whole world by the currently set Temperature value
Water Level			Decrease the water level of the whole world by the currently set Water Level value
Global Smooth >>			
Land Offset			Blurs the land offset (altitude) editing map
Land Roughness			Blurs the land roughness editing map
Rainfall			Blurs the rainfall editing map
Temperature			Blurs the temperature editing map
Extra Large			Use the extra large (XL) brush size for painting to the world
Large			Use the large (LG) brush size for painting to the world
Small			Use the small (SM) brush size for painting to the world
Extra Small			Use the extra small (XS) brush size for painting to the world
Burn Into Surface			Converts the current world into a map in the land offset channel
Mound			Fills the current selection with land offset values from the selection's edge to its center

Select menu

All	Selects the entire world
Deselect	Removes the current selection
Inverse	Inverts the current selection
Altitude Range	Selects portions of the world by altitude
Climate Range	Selects portions of the world by climate range
Rainfall Range	Selects portions of the world by rainfall range
Temperature Range	Selects portions of the world by temperature range
Binarize	Removes feathering from the current selection mask
Feather	Softens (feathers) current selection mask
Modify >>	
Expand	Expands the current selection mask by 1 pixel in all directions
Contract	Reduces the current selection mask by 1 pixel in all directions
Load Selection	Loads a selection mask file
Save Selection	Saves the current selection as a selection mask file

View menu

World Tools	View or hide FT's icon bars: Toggle the World Tools icons
Map Tools	Toggle the Map Tools icons
Globe Tools	Toggle the Globe Tools
Status Bar	Toggle the Status Bar
Tool Palette	Toggle the Tools Palette icons
Map Info	Toggle the Map Info window
Color Key	Toggle the Color Key window
Climate Selector	Toggle the Climate Selector icons
Selection Tools	Toggle the Selection Tools icons

Help menu

Help Topics	Open FT's help file
About Fractal Terrains	Display current FT version and program details

Selection Tools

Select Rectangle



Rectangular selection tool

Select Ellipse



Elliptical selection tool

Select Freehand



Freehand selection tool

Select Polygon

Polygonal selection tool

Climate Selector

Used to select the climate type to paint

Boreal



Chaparral



Desert



Grassland



Hills



Ice



Mountains



None



Bare Rock



Savannah



Temperate Forest



Tropical Evergreen Frst.



Tropical Deciduous Frst.



Tropical Shrubland



Tundra

**Other Icons**

Zoom In



Zoom world view in by a factor of two

Zoom Out



Zoom world view out by a factor of two

Zoom Whole World



Zoom whole world to fit in the current window

Zoom Window



Zoom into a selected area (left-click opposite corners of the area to be zoomed)

Distance



Measures a linear distance

Pan



Move the current world view (left-click and hold to drag the view)











Context-Sensitive Help



Gain help on the selected item

Other Keyboard Functions

FT supports some additional keyboard features, and these are described below:

Function	Keyboard/Icon Shortcut
Show next world without losing edits	
Show previous world without losing edits	
Cancel offset or projection move	 when releasing button in map projection dialog
Add new selection to current selection	 when left-clicking to end use of a selection tool
Remove new selection from current selection	 when left-clicking to end use of a selection tool
<i>Example:</i> To select a rectangular area, click on the Select Rectangle icon  , click in the main window to place one corner of the desired selection area, then hold  or  down when left-clicking to place the opposite corner to add or remove from the current selection, respectively.	
Reset toolbar positions to default	Hold  during startup
Prevent load of default file	Hold  during startup

Icon Bars

FT's icons are contained within standard Windows® floating icon bars. Each icon bar and window may be hidden or displayed via the **Tools menu**. If the name of an icon bar appears with a tick beside it in that menu, it is currently shown. Clicking on the name of a tool bar will add or remove this tick, and accordingly show or hide the tool bar.

For reference, the icon bars are as follows. The functions of the icons are outlined above:

Icon Bar

World Tools

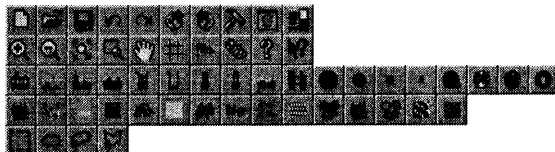
Map Tools

Tool Palette

Climate Selector

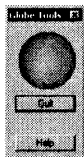
Selection Tools

Icons



Information Windows

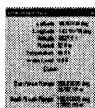
There are three additional floating windows comprising the FT interface, and these can be hidden, dragged, or placed within the main window just as icon bars. These are summarized below:



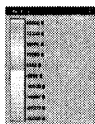
Globe Tools This window contains a globe that can be rotated to adjust the current world view. Left-click and hold on the globe, and move the cursor to rotate it. The world view will pan accordingly.

Clicking Quit will exit FT.

Clicking Help will open FT's help file.



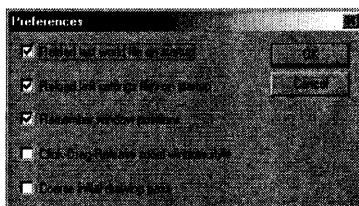
Map Info This window contains general information about the current world, or the portion of the world beneath the mouse cursor.



Color Key This window keys the contour colors used for the current world. There are four versions of the color key window, one for each of the information views (Altitude, Climate, Rainfall, and Temperature).

Preferences


FT allows a certain amount of customization in the way it works. You can alter your preferences by selecting Edit menu >> Preferences, which presents the Preferences dialog box:

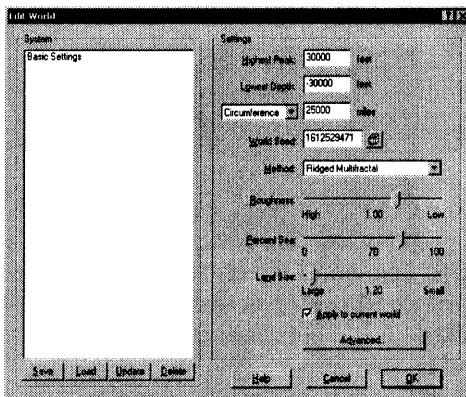


- ✓ **Reload last world file on startup** will automatically open the last saved world you worked on with FT on startup if it is checked. If it is not checked, FT will generate a new random world on startup.
- ✓ **Reload last settings files on startup** will cause FT to automatically use the last saved world generation and color files on startup. If it is not checked, FT will use the default settings.

- ✓ **Remember window position** will cause FT to open in its last used window position on startup, otherwise the default position will be used. Note holding **Shift** during startup has the same effect.
- ✓ **Click-Drag-Release zoom window style** alters the way the Zoom Window function works. If checked, zoom windows are drawn by clicking at one corner, holding the mouse down, dragging to the opposite corner, and releasing the mouse. If unchecked, zoom windows are drawn by clicking at one corner, and separately clicking on the opposite corner of the window required. By default, this is unchecked.
- ✓ **Coarse initial drawing pass** changes the way FT draws worlds to the screen. If checked, the world view will initially drawn using coarse pixels, creating a blocky-looking view to start with. This view will be subsequently refined by FT as time passes until all generated world data has been drawn. This is useful for quickly seeing the general form of a world before either accepting or rejecting it. If unchecked, FT will fill in the world view's pixels layer by layer, gradually filling in the detail. This is the default method.


World Settings

When you create a synthetic or flat world, you will be presented with the World Settings dialog box. You can also access this dialog to edit the currently used settings by clicking on the **World Settings** icon .



- ✓ The **System** group contains world settings file management controls. Click on **Save** to save the current settings to a file. Select a file from the list and click on **Load** to load the settings contained within it. Click on **Update** to save changes to the currently used setting file. Select a file from

the list and click on **Delete** to remove the file from your system.

- ✓ **Highest Peak** sets the maximum altitude for the world. Sometimes the generated world may exceed this value, but it usually keeps within bounds.
- ✓ **Lowest Depth** sets the lowest point in the ocean. Sometimes the generated world may exceed this value, but it usually keeps within bounds.
- ✓ The **Circumference or Diameter** (depending on the option selected from the drop-list) sets the size of the world. If **Circumference** is selected, the value is the distance around the world at the equator. If **Diameter** is selected, the value is the distance through the north and south poles. All worlds are assumed to be perfectly spherical, not an oblate spheroid like the earth.
- ✓ The **World Seed** is the world number to generate. It sets the random number seed for the internal generators. Values for this seed can range from negative 2,147,483,648 to positive 2,147,483,647. Click on  to randomly allocate this value.
- ✓ Method selects the way in which the world altitude will be computed. The two options are available: **Ridged Multifractal**; and **Brownian Noise**. **Ridged Multifractal** is composed of many ridges at different scales. **Brownian Noise** is basically just random noise at different scales without any particular structure:



Ridged Multifractal

Brownian Noise

✓

- ✓ The **Roughness** slider controls the level of roughness in a surface. This value is roughly the fractal dimension of the surface. The sequence below shows how Roughness affects the surface from high (0.01) to low (1.49):



0.01



0.38



0.75



1.13



1.49

- ✓ **Percent Sea** sets the rough amount of sea that will be found on the map.
- ✓ **Land Size** sets the size of the land masses. The sequence below shows how the changing the setting changes the land mass size:



1.00



2.14



3.25



5.50



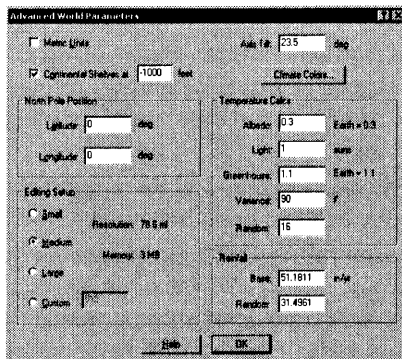
10.00

The smaller the land size setting, the more continents (or islands) you will get. A value of around 1.6 usually provides good results.

- ✓ If checked, **Apply to Current World** will apply any changes in the world parameters to the current world, preserving any terrain editing. If unchecked, all editing will be lost.
- ✓ Click on the **Advanced** button to access the Advanced World Parameters dialog box (see below).
- ✓ **OK** accepts any changes made to the world settings and creates a new world with those settings.
- ✓ **Cancel** discards any changes and keeps to the current world.
- ✓ **Help** gets help for this dialog.

Advanced World Parameters

These settings allow you to affect the way in which the world is calculated. You may also change climate coloration, the location of the northernmost pole, axial tilt, etc.



- ✓ **Metric Units**, if checked, changes all measurements to metric (kilometers, meters, centimeters, and degrees Celsius). If unchecked, measurements will be in Imperial units (miles, feet, inches, and degrees Fahrenheit).
- ✓ If checked, **Continental Shelves** indicates that the continental margins will be computed. The value on this line is the depth at which the shelves will be generated. The pair of images below shows how a world appears with and without continental shelves. Note how turning on Continental Shelves can reduce the relative altitudes of some parts of the map.



With continental shelves



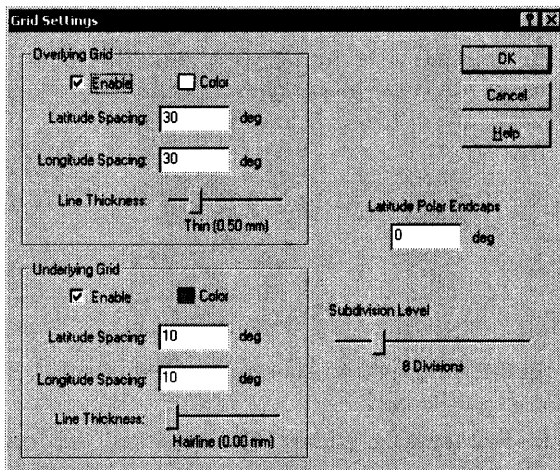
Without continental shelves

- ✓ The **North Pole Position** group controls the location of the north pole. Changing this value will rotate the map around in its coordinate system. The change will not be applied to any terrain editing changes. **Latitude** and **Longitude** specify the new location on the sphere through which the pole will pass.

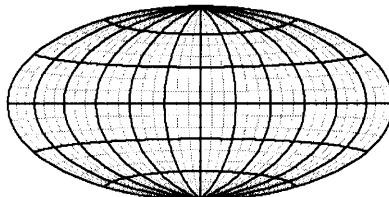
- ✓ The **Editing Setup** group sets how the resolution at which editing will be accomplished. **Small**, **Medium**, and **Large** set 256, 512, and 1024 samples horizontally respectively. **Resolution** and **Memory** indicate how big each sample will be at the equator and how much memory the editing surface will require. Specifying a surface that takes much more than a small fraction of the machine's physical memory size can result in poor performance during editing. **Custom** sets a custom editing size in case one of the other settings isn't to your liking.
- ✓ **Axis Tilt** specifies the axial tilt of the planet. This parameter affects the temperature distribution of the world.
- ✓ The **Temperature Calcs** group controls the settings for the temperature model. All values are average for an entire year. **Albedo** is the amount of reflectance that the world has (sum of all factors including clouds, land, and sea); an Earth-like world will have a value near 0.3. **Light** indicates the amount of sunlight at all wavelengths reaching the planet in terms of solar radiation units (the Sun = 1). **Greenhouse** indicates the greenhouse warming effect due to atmospheric effects; Earth has a value of approximately 1.1. Values less than 1 have a cooling effect, values greater than 1.0 have a warming effect. **Variance** is a factor that determines how much the temperature varies from the equator to the poles. Earth has roughly a 90°F variance value. **Random** is the amount that a random field will be scaled by to give local temperature disturbances.
- ✓ The **Rainfall** group controls the amount of rainfall. **Base** is the global amount of rainfall. **Random** is a scaling factor that adjusts a fractal field that adds to the Base value to give the final result.
- ✓ Clicking on the **Climate Colors** button brings up the Climate Coloring dialog.

Grid Settings

The Grid Settings dialog box allows you to set a grid for your world.

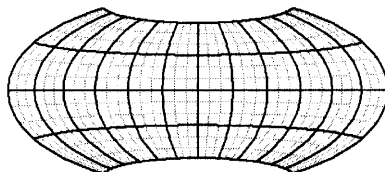


For the above settings, a grid like that shown below will be generated:



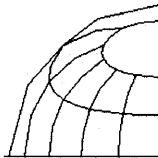
Note how there are two grids: a thick-lined black grid and a thin-lined gray grid. The black grid is the overlying grid, and the thin gray grid is the underlying grid.

- ✓ **Latitude Endcaps** is the amount of latitude around each pole that will not be drawn. As can be see in the above example grid, the polar regions get a bit cluttered when the lines all intersect. The image below shows the same settings as before, but with 30° latitude endcaps in place:

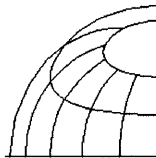


- ✓ **Subdivision Level** is the number of segments between each intersection. For example, a subdivision level of 2 using 30°

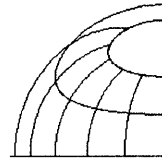
increments will give a total of 24 line segments along the entire 360° of longitude. For some map projection (Equirectangular, for example), a very low number of subdivisions is usable. For others, such as the Azimuthal Equidistant, it just isn't enough. Note that higher subdivision levels will cause longer re-draw times. The images below show how 2, 4, and 32 subdivisions appear:



2 subdivisions



4 subdivisions



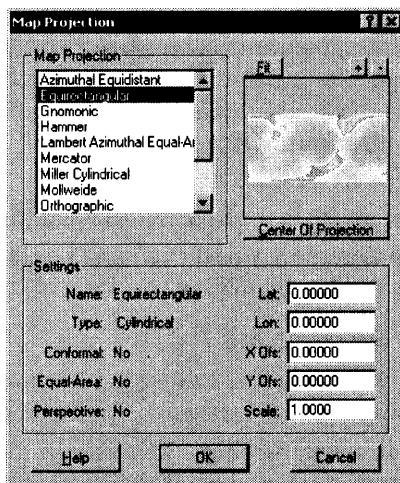
32 subdivisions

For both the **Underlying Grid** and **Overlying Grid** groups, the controls have the following meanings:

- ✓ **Enable** turns the grid on. If not checked, the grid will not be drawn.
- ✓ Click on the **Color** box to select the color used for the grid.
- ✓ **Latitude Spacing** is the vertical interval at which horizontal gridlines will be drawn.
- ✓ **Longitude Spacing** is the horizontal interval at which vertical gridlines will be drawn.

Map Projections

As noted within the tutorials, displaying a globe across a flat surface provides a unique problem to which there are many solutions. Here, we shall discuss some of those solutions, and explain some of the finer points of the Map Projection dialog box:



- ✓ The **Map Projection** list holds the types of projections that can be displayed.
- ✓ **Fit** fits the projection to a square windows (sets the scale to 1.0).
- ✓ The **+** button zooms in by a factor of 2.
- ✓ The **–** button zooms out by a factor of 2.
- ✓ **Center of Projection** functions as a checkbox. When pressed, it will stay in; when pressed again, it will come out. When in, clicking the mouse on the map display and dragging it will change the center of projection (**Lat** and **Lon**). When out, clicking the mouse on the map display and dragging it will change the offset (**X Ofc** and **Y Ofc**).
- ✓ **Lat** and **Lon** indicate the current latitude and longitude of the center of projection. **Lat** can never be forced exactly to 90 or –90, but can get very close.
- ✓ **X Ofc** and **Y Ofc** control the current position of the map (0,0 means that the center of the map is directly over the center of projection; values from –1 to +1 move the map around).

- ✓ **Scale** sets the zoom level for the map. Values larger than 1 zoom out (make the map appear smaller), while values smaller than 1 zoom in (make the map appear larger).
- ✓ **Name, Type, Conformal, Equal-Area, and Perspective** provide feedback about the current map projection. **Name** is the projection name. **Type** is the general class of projection (cylindrical, pseudo-cylindrical, etc). **Conformal** indicates if the projection preserves shapes. **Equal-Area** indicates if the projection preserves areas. **Perspective** indicates if the map is projected onto a point.
- ✓ **Help** gets help for the dialog.
- ✓ **OK** accepts the map projection and redraws the map.
- ✓ **Cancel** discards any modifications to the projection and returns to the main display.

A Glossary for Projections

Many of the terms used in the context of map projections may be unfamiliar. The terms below are commonly encountered:

Azimuthal Projection – A projection in which the azimuth or direction from a central point to any other point is shown correctly.

Conformal Projection – A projection in which all angles at each point are preserved. This is approximately the same as saying that shapes are preserved.

Cylindrical Projection – A projection resulting from a conceptual projection of the surface points on the sphere passing through the points on a cylinder that is tangent or secant to the sphere. The resultant cylinder is then cut and laid flat.

Equal-area Projection – A projection in which areas are shown proportionate to each other as they are on the surface of the sphere.

Equatorial Aspect – View of an azimuthal projection where the center of projection lies on the equator.

Equidistant Projection – A projection that maintains constant scale along all great circles from one or two points.

Perspective Projection – Projection produced by projecting straight lines radiating from a selected point (or from infinity) through points on the surface of a sphere, and then onto a tangent or secant plane.

Polar Aspect – View of an azimuthal projection where the center of projection lies on one of the poles.

Supported Projections

FT supports a number of projections for various purposes. The default projection is Equirectangular.



Azimuthal Equidistant

An azimuthal projection capable of showing the entire world at once. Scale between any two points along a line passing through the center of the projection is true. Distorts the shapes and areas of places on the world. Examples of maps using this projection are found as early as the 16th Century.



Equirectangular

This cylindrical projection has the useful property that the scale is constant and true along meridians and the equator. It is by far the simplest projection to construct, being a simple graph of latitude vs. longitude. It distorts both shape and area, with the distortions increasing relative to distance from the equator.

The version of the Equirectangular project used by FT is actually a special case called Plate Carree. In this projection, latitude and longitude are equal in size. It may have been originated by Eratosthenes in ancient Greece, and was widely used in the 15th and 16th Centuries.



Gnomonic

This azimuthal projection has several useful properties, but does not preserve shape or area. It has the useful property that a straight line on the map will give the shortest distance between those two points. It cannot display the full world, being limited to less than a hemisphere. Another of the projections thought to originate in ancient Greece (this time with Thales), its name is derived from the gnomon on a sundial.



Hammer

This equal-area projection is popular because it reduces distortion in many areas compared to similar projections. It has an elliptical border, which makes it rather decorative as well as functional. Developed in 1892 by H. H. Ernst von Hammer, this projection is widely used where whole-world, equal-area maps are desired.



Lambert Azimuthal Equal-Area

This projection is commonly used in atlases for maps of polar regions and Northern and Southern hemispheres. The equatorial aspect is commonly used for maps of the Eastern and Western hemispheres. This equal-area projection is classified as azimuthal.



Mercator

The Mercator projection is the familiar world map in elementary schools. This is an unfortunate fact, because the map has severe distortions of area in the polar regions (which is why Greenland looks bigger than South America). The Mercator projection, while conformal, is infinite in extent (the North and South Poles lie at + infinity and minus infinity respectively). This cylindrical map has the useful property that lines of constant true bearing are straight lines. As such, it is useful for navigation. It was presented by Gerardus Mercator of Flanders in 1569.



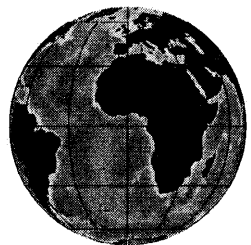
Miller Cylindrical

This cylindrical projection is neither conformal nor equal-area. It is closely related to the Mercator projection, but manages to keep the extreme polar distortions a little more under control. It was developed in 1942 by Osborn Maitland Miller of the American Geographical Society, and was used in many American atlases.



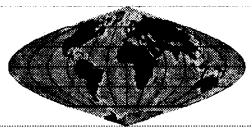
Mollweide

A pseudocylindrical projection, Mollweide is used in thematic and atlas maps of the world. Distortions are severe at higher latitudes and towards the outer edges, but the scale is true at latitudes $44^{\circ}40'$ north and south. It was presented by Carl B. Mollweide of Germany in 1805.



Orthographic

This azimuthal projection shows the world as it would appear if viewed from infinity. It cannot show more than a single hemisphere at a time. The small positioning globe on the main FT interface is implemented using the Orthographic projection.



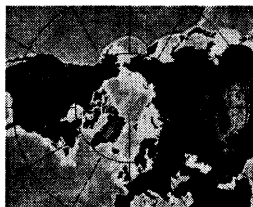
Sinusoidal

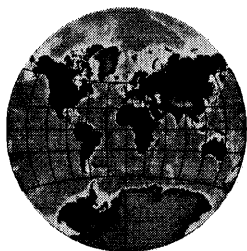
This pseudocylindrical projection has the useful feature that it is relatively easy to compute and is equal-area. It does suffer from significant shape distortion, especially at high latitudes and near the outer edges. It was developed in the 16th century and used in some atlases in the 17th century, sometimes appearing in modern articles desiring to show relative areas.



Stereographic

The stereographic projection is a conformal azimuthal projection commonly used in the polar aspect for topographic maps of the Polar regions. The equatorial aspect was used in the 17th and 18th centuries for maps of the Eastern and Western Hemispheres. While the projection cannot show the whole world, it is quite useful for mapping areas which are roughly circular in extent. Its origins (in polar aspect) may date to the Egyptians and Greeks by the second century B.C.





Van Der Grinten

The Van Der Grinten projection is a polyconic projection that is neither conformal nor equal-area. It encloses the entire world in a circle, but causes great distortions of area near the poles. The scale is true along the equator, but increases rapidly towards the poles. It was presented by Alphons J. van der Grinten of Chicago in 1898.



Wagner IV

A pseudocylindrical projection, Wagner IV is equal-area but not conformal. It was developed in 1934 by Putnins in Latvia, but was popularized by Wagner of Germany in 1949. Shape distortion is not as extreme in the polar regions as is that of the pointed equal-area projections such as sinusoidal, but is still considerable.

Bibliography

Some books that also can help in the understanding of map projections are:

An Album of Map Projections (Snyder and Voxland; US Geologic Survey Professional Paper 1453)

Map Projections – A Reference Manual (Bugayevskiy and Snyder; ISBN 07484 0304 3)

Flattening the Earth (Snyder; ISBN 0-226-76747-7)

The Album is out of print, but the others are readily available.

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FT Full Version

Serial # 7PK1946733



FRACTAL TERRAINS



The best of all possible worlds



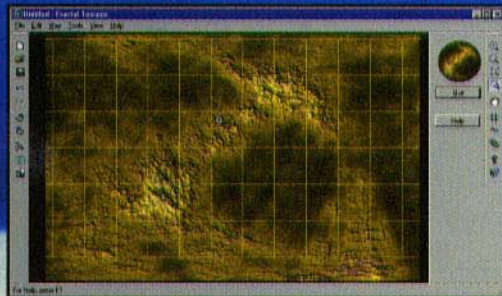
Use easy editing tools to change height, roughness, temperature and other map properties.



Add lines of latitude and longitude to any view.



See detailed map information such as altitude, climate and water level at the cursor.



Customise your lighting and coloration schemes to produce a wide variety of worlds.

Fractal Terrains gives you infinite worlds at your fingertips. Pull a few sliders, type in a few details, and FT will create any number of beautiful random worlds based on your parameters.

You can control the percentage of land and sea, whether you have many islands or a few large landmasses, and whether you have jagged fjords or smooth coasts. You can set the diameter and height-range of the world and even add continental shelves. You can save your settings so that you can have as many Earth-like, Moon-like or Mars-like planets as you want.

Once you've chosen your settings you can quickly go through variations until you have the world you desire. If you want something more down to earth, use real world satellite data as a starting point for your maps. Earth and Mars data is included on the CD.

When you've chosen a world you can edit it, adding terrain, changing temperatures, climate or even raising the sea level across the whole globe. Want to see Europe in the Ice Age? Just lower the sea level. Flatten the Rockies? Just select the 'lower' tool and scrub away.

Move the cursor over the globe to see the altitude, temperature, rainfall and even the climate type at any point. Create relief maps, temperature maps, rainfall maps and climate maps, all color-coded. Add lines of latitude and longitude.

You can control what you see using a rotatable globe and a selection of zoom tools. Zoom in and FT will show you what you see at a great depth of detail. You can choose a predefined color scheme, or invent one of your own. The world can be viewed and edited using any of the standard projections used in most atlases. The images are beautifully shaded, and FT lets you change the angle and strength of the lighting.

When you have finished creating the world, you can export it to Campaign Cartographer 2 or Campaign Mapper, contours and all, across multiple linked maps. In addition, FT supports JPEG, bitmap, spin view, linked HTML and VRML export.

As a stand-alone product or used with CC2, FT is a powerful and useful tool for gamers of all genres, world creators, geographers and authors alike.